January-February 1981
Volume 25
Number 1

Mariners Weather Log

National Oceanic and Atmospheric Administration • Environmental Data and Information Service

U.S. DEPARTMENT OF COMMERCE
Philip M. Klutznick, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Richard A. Frank, Administrator

ENVIRONMENTAL DATA AND INFORMATION SERVICE.
Thomas D. Potter, Director

Cover: The 500-ton German coastal freighter KAAKSBURG was blown high aground on the rocks of the Isle of Lundy on the Cornish coast. Six men and a woman on board jumped from the ship's deck onto the rocks. After scaling a small cliff, they were rescued by a Royal Air Force helicopter. Wide World Photo.

Mariners Weather Log

Editor: Elwyn E. Wilson
Editorial Assistant: Annette Farrall

January-February 1981
Volume 25 Number 1
Washington, D.C.

Routing
Master _____

Observing Officers
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Radio Officer _____

PARTICIPATE IN AMVER

PLEASE PASS THIS ISSUE ALONG

The Secretary of Commerce has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1983.

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Mariners Weather Log

SEA ICE DETECTION USING ENHANCED INFRARED SATELLITE DATA

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An enhancement of Advanced Very High Resolution Radiometer (AVHRR) thermal infrared (IR) data from NOAA polar-orbiting satellites has been designed for operational use in the detection of the sea-ice edge in Alaska waters. A split-level enhancement delineates sea ice (-4°C to 2°C), near freezing seawater (-1.5°C), and sea-surface temperature (SST) of open-water areas (-1.0°C to 5.5°C). Applications of the enhancement in the Bering Sea and Cook Inlet for the 1979-80 winter are given. The enhanced imagery is useful for analysis, especially for locating the ice edge when younger ice forms are involved. Ground truth is shown to support this new analysis technique.

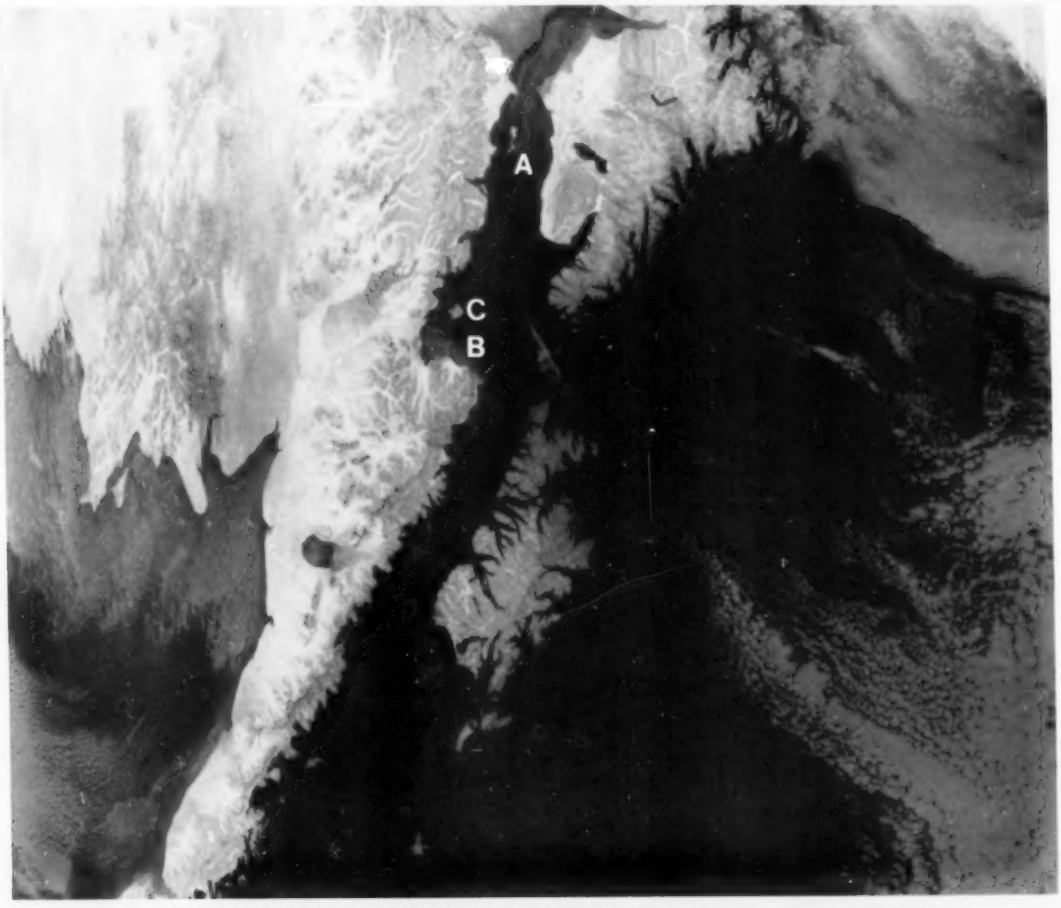


Figure 1.--AVHRR-IR image of the Cook Inlet-Gulf of Alaska region for January 2, 1980.

Both visual (0.55 to 9.99 μm) and thermal infrared (10.5 to 11.5 μm) data from NOAA polar-orbiting satellites are used routinely to distinguish sea-ice features. In the past, ice conditions generally were determined through comparison of visible and IR data. Low sun angles and short days during midwinter at the high latitudes of Alaska inhibit the use of visual imagery. Infrared data, however, are little affected by these seasonal changes, and during winter offer more flexibility for use in the detection and identification of sea ice, its fracture patterns and stages of development, than visual images. In visual images where there is no snow cover, sea-ice concentrations of less than 3 to 4 tenths, and most new ice, cannot be distinguished from open water.

Surface thermal gradients of sea ice are governed by two factors--conduction of heat from warmer water beneath the ice and solar radiation. Solar radiation effects become less evident from the high altitudes (> 800 km) of polar-orbiting satellites because of the greater spatial integration in the larger field of view. The surface temperature of sea ice is predominantly determined by the high and constant water temperature. Old ice that is 2 to 3 m thick will appear cold in an IR image because little heat is conducted from beneath. First-year ice less than 2 m thick and other younger forms appear warmer.

Wintertime fishing and commercial shipping have expanded significantly in Alaska waters. For example, king crab fishing is concentrated along the ice edge in the eastern Bering Sea. Since crab pots cost an average of $500 each and are left in place from 1 to 4 days, the crabbers need accurate information on the location of the ice edge, its movement, and its rate of growth or recession. Commercial fishing for herring in April along the Bristol Bay coast has developed only in the last 2 yr and is growing rapidly. In 1980 the Alaska Department of Fish and Game opened the commercial fishing season in upper Bristol Bay on April 15. There is continuing concern about the location of the ice and whether or not the fleet can operate safely and efficiently at this time of year. Energy exploration and supply activities also depend heavily on detailed ice information. This paper presents a new technique to assist

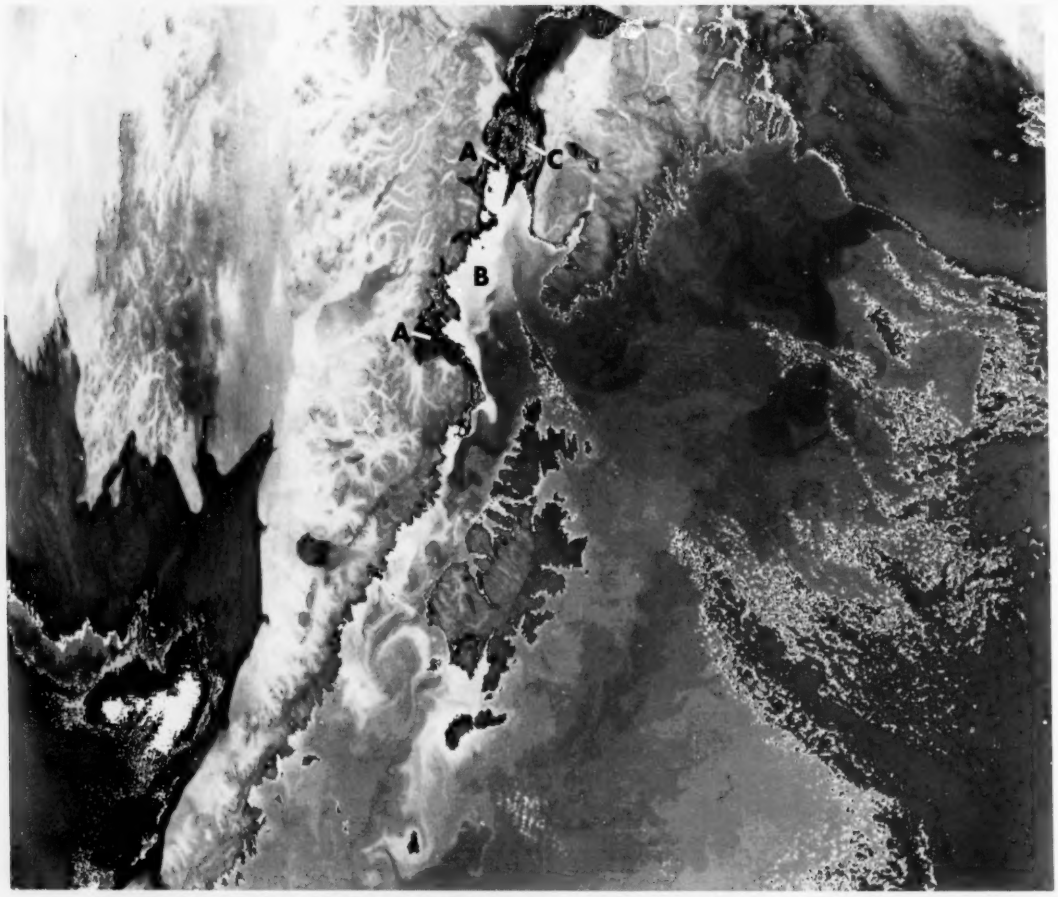


Figure 2.--Enhancement of the AVHRR-IR image in figure 1 for sea ice and SST.

analysts in quantifying the sea-ice edge and associated younger ice forms and sea-surface temperatures of water adjacent to the ice edge. These data together with synoptic meteorological data can be used in the prediction of ice-edge expansion or recession. Examples of the use of this enhancement in Cook Inlet and the Bering Sea are discussed.

The NOAA AVHRR IR sensors on board the polar-orbiting satellites provide up to eight passes daily of digital data over Alaska. The IR sensors provide data over a temperature range of -80°C to 40°C in 1,024 digital steps or counts with a resolution of about 1 km. These data can be displayed as an image using 32 gray shades to represent the broad range of temperatures observed by the spacecraft. White represents the coldest, with darker gray tones representing warmer temperatures. Black is the warmest temperature.

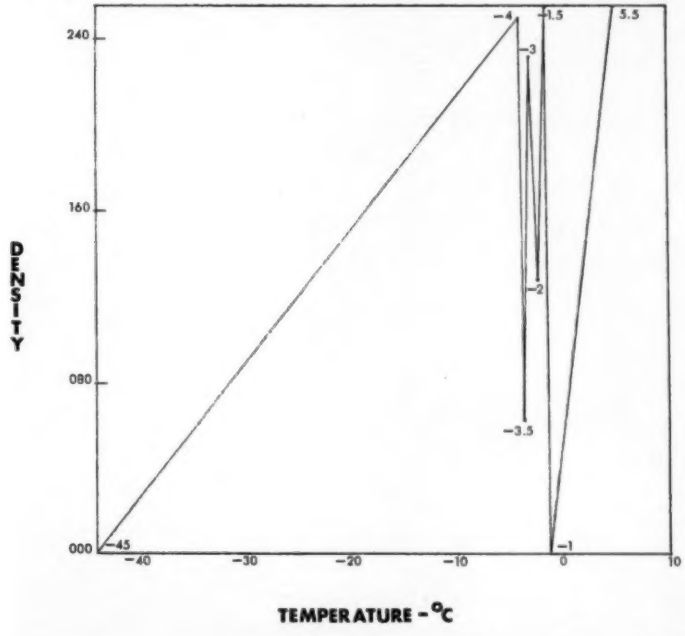
The human eye cannot distinguish between 32 gray shades; tests indicate that most individuals can distinguish only 9 to 10. An example of the amount of data hidden in the image can be seen in figures 1 and 2. The display of IR data over Cook Inlet (fig. 1) represents a temperature range of 50°C. Figure 2 is the same image where the gray shades represent a temperature range of only 10°C, typical of the range of ice and sea-surface temperatures. This example illustrates the enhancing function, whereby any gray shade can be chosen to represent a narrow range of temperatures or a specific value, regardless of where the gray shade falls within the 32-step scale. The remainder of the temperature range can be blocked out by making it all one gray shade.

An important element in producing effective enhancement is the selection of the temperatures and/or ranges that are to be accentuated. Examination of the scientific literature, past records of observations, and discussions with researchers were helpful in making the selection.

Conclusions drawn from the references indicate that for the northern Bering Sea, sea-ice formation takes place at -1.7°C with a surface salinity of 31.5 parts per thousand. Progressing southward, surface salinity increases until a maximum of 33 parts per thousand is reached over the deep basin in the southwestern Bering Sea. The freezing point for this water would be -1.8°C. For Cook Inlet, 15 yr of records from oil production platforms in Cook Inlet show that sea ice will not form until a water temperature of -1.5°C is attained with a salinity of 28 parts per thousand. By including temperatures above and below the freezing point for a given area, one should obtain a range for enhancement that will contain the sea-ice edge, near freezing water, and warmer temperatures in open water.

A split-level enhancement was chosen for both Cook Inlet and the Bering Sea that delineates clouds and land (-45°C to -4°C), sea ice (-4°C to -2°C), near freezing water (-1.5°C for the Bering Sea, -1.0°C for Cook Inlet), and open water temperatures (-1.0°C to 5.5°C). Sea ice is shown in 4 gray shades (light gray to medium gray in the Bering Sea, light gray to black in Cook Inlet), with sea water represented by 10 shades (white to black) at 0.5°C intervals. Details of this enhancement are given in figure 3.

From January 23 to February 12, 1980, surface observations of the sea-ice edge were obtained from the NOAA research ship MILLER FREEMAN, which was conducting a herring fishery survey between the Alaska Peninsula and St. Matthew Island. Ice edge positions determined from the split-level enhancement were sent



TEMPERATURE	GRAY SHADE
-45 to -4 °C	white to dark gray
-3.5 °C	light gray
-3.0 °C	dark gray
-2.0 °C	medium gray
-1.5 °C	black
-1.0 to 5.5 °C	white to black

Figure 3.--Split-level IR enhancement with special identity, -4°C to -2°C, with -1.5°C black, -1°C to 5.5°C.

to the ship approximately every 2 days. The observed ice edge information from the ship was then transmitted via the U.S. Coast Guard Kodiak Communications Station back to the Anchorage Satellite Field Services Station 2 days later. Comparison of the satellite-observed and ship-observed positions indicates that the average difference in location was 10 km with an extreme of 18 km. However, the ship observations of the ice edge are for single points and do not include the pattern over the entire area that is shown on the satellite imagery. Some of the differences in location of the ice edge may be explained by what the ship's observer defined as the ice edge. Figure 4 shows bands of sea ice near the ice edge. These bands have been shown to have an approximate width of 10 km.

In the Cook Inlet enhancement (fig. 2) the black-colored ice edge (A) is distinguished from the open water (B) (white to dark gray). The thicker areas of ice (C) are light to medium gray.

In the normal IR display for January 2, 1980 (fig. 1), the ice edge appears to be about 9 km south of Kalgin Island (A) with some ice in Kamashak Bay (B), west of Augustine Island (C). The enhanced image (fig. 2) shows a band of black, signifying new or slush ice extending south about 37 km from Kalgin Island. This feature was verified by an overflight on the same day. In Kamashak Bay the enhancement shows ice surrounding Augustine Island, while the broad range IR image indicates

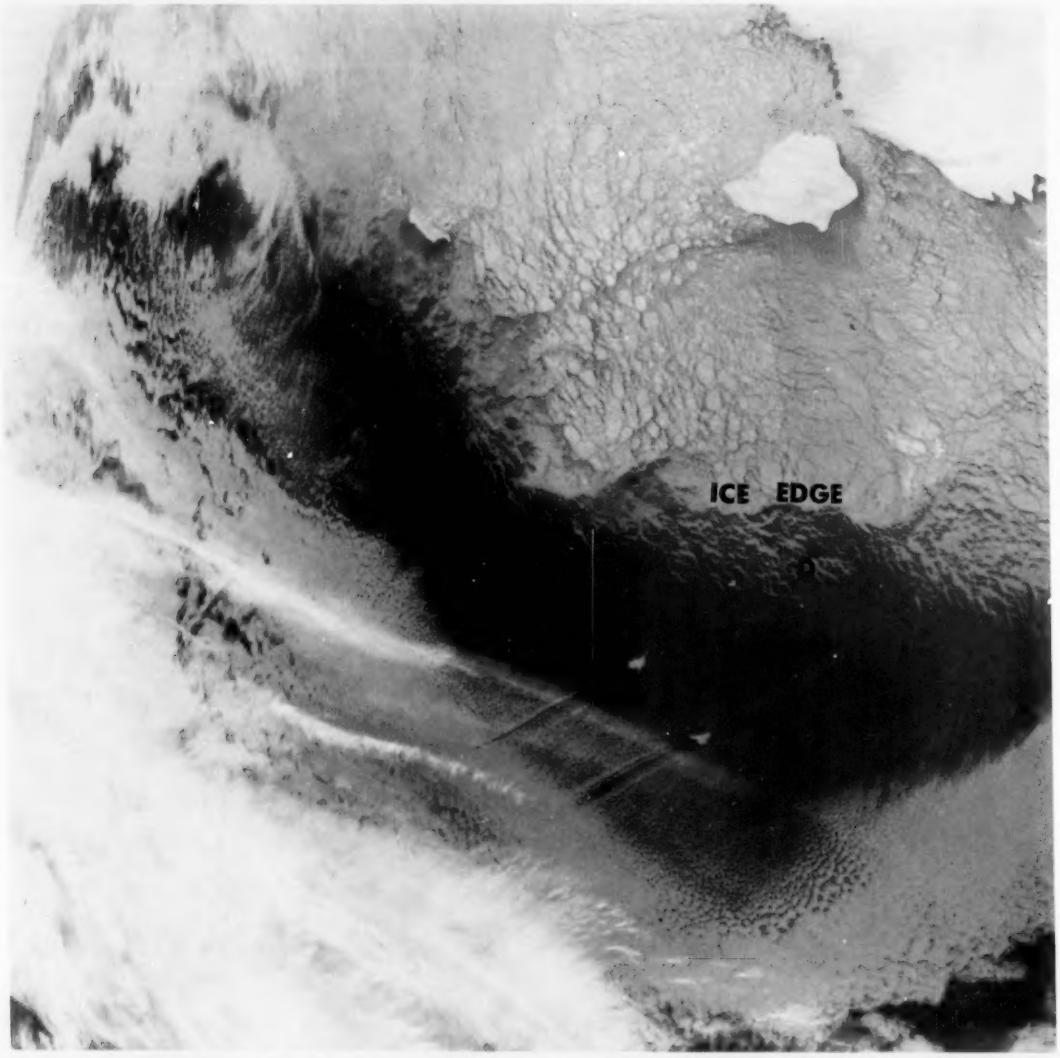


Figure 4.--AVHRR-IR image of the eastern Bering Sea for January 22, 1980.

no ice around the island. In the SST structure seen in this enhanced IR data southwest of Kodiak Island, the temperatures range from 0°C to 3°C.

Figure 4 is an IR image of the eastern Bering Sea on January 22, 1980. The ice edge is readily apparent. In the upper right of the image is Nunivak Island; to the left is St. Matthew Island. The two islands in the lower middle of the image are the Pribilofs. South of the Pribilofs are bands of clouds. An interesting feature is the presence of bands of ice (D) that are at right angles to the reported northeast wind direction. Figure 5 is a split-level enhancement of figure 4. The most interesting feature is that the bands to the south of the ice edge are composed of thick (-3°C) ice. New or slush ice, depicted by the salt-and-pepper display, is seen between the ice bands and the ice edge (fig. 5). Seaward of the ice bands is a black zone signifying near-freezing seawater (-1.5°C). The tongue of -1.5°C water (E), which has been observed in past years at St. Paul Island, can be seen in the image extending southward to surround St. Paul Island. Using conventional synoptic meteorological data sources along with the position of the near-freezing seawater observed in the imagery, ice forecasters have a powerful new tool for the prediction of the ice edge position. In this case, new ice was observed around St. Paul Island 6 days later on January 28, 1980, an excellent verification of this new technique.

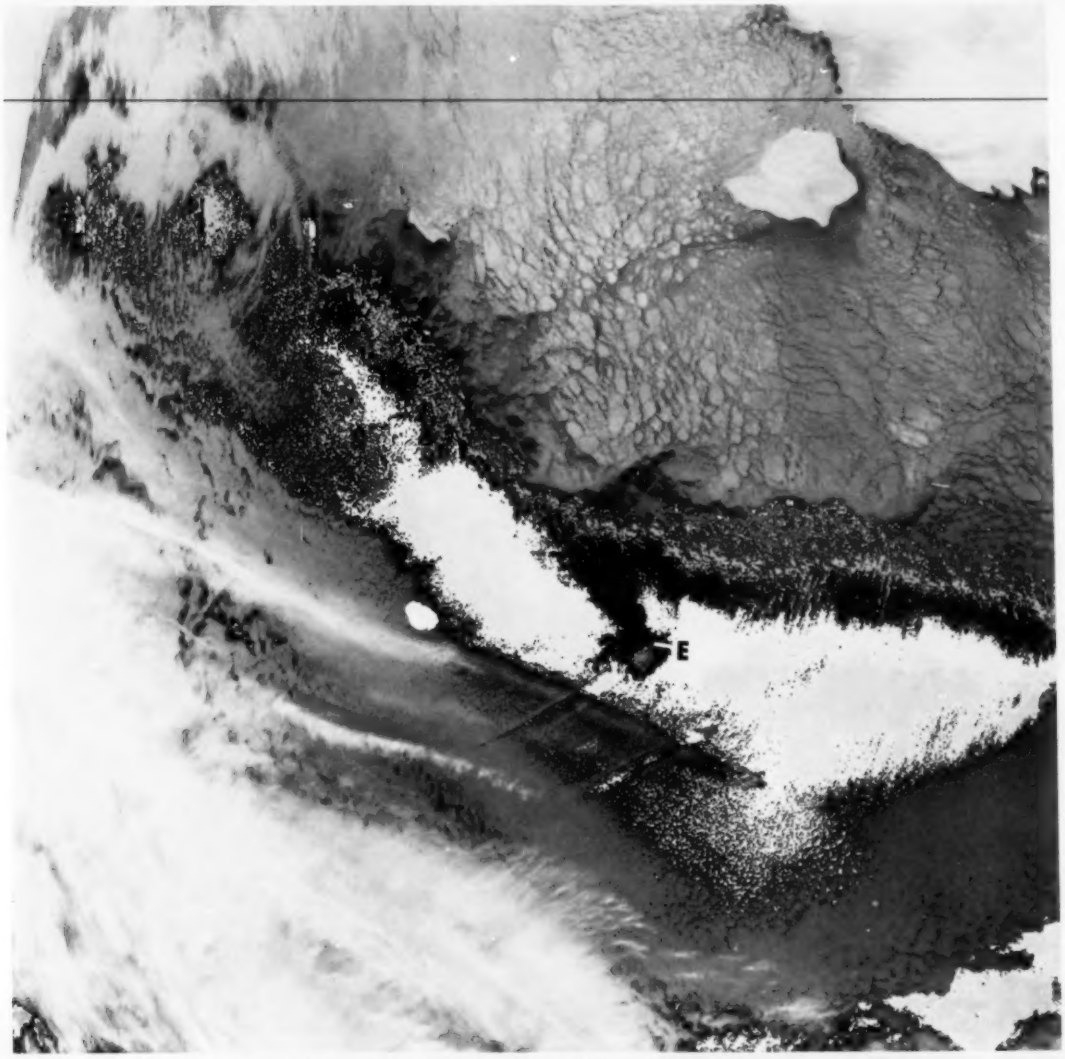


Figure 5. --Enhancement of the AVHRR-IR image in figure 4 for sea ice and SST.

Remotely sensed data from NOAA's two operational polar-orbiting satellites afford the ice analyst the opportunity to assess changes in ice conditions around Alaska on a synoptic scale. Enhanced IR displays provide quantitative information in this data-sparse area, that should provide a better understanding of the behavior of ice in the Bering Sea and Cook Inlet.

The enhancement technique may not work when the ice begins to melt in the spring. Meltwater on the ice causes the infrared sensor to indicate open water when heavy ice is still present. Thus, the visible imagery should be used in conjunction with the enhancements after the ice begins to melt. Further verification of the enhancement technique with ship observations during spring melt is planned for the near future.

WE OF NOAA ARE MAKING USE OF THIS SMALL AMOUNT OF SPACE TO EXTEND OUR THANKS TO ALL THE SHIPS' OFFICERS WHO ROUTINELY TAKE SHIPBOARD WEATHER OBSERVATIONS. TO US, THESE EXCELLENT OBSERVATIONS ARE PRICELESS. WE CERTAINLY DO APPRECIATE RECEIVING THEM REGULARLY.

Mariners Weather Log

REPAIR OF U.S. SEAWAY LOCKS

Elwyn E. Wilson
Environmental Data and Information Service, NOAA
Washington, D.C.

The St. Lawrence Seaway celebrated its 20th birthday during 1979, and there were signs of aging. The St. Lawrence Seaway is operated jointly by the United States and Canada. The Eisenhower and Snell locks are under U.S. jurisdiction (fig. 6). As soon as the last ship, the MAPLECLIFFE HALL, cleared the locks on December 22, 1979, work started immediately. Each year there is a normal winter maintenance program while the Seaway is closed, but that year it was much more comprehensive. Additional temporary employees were hired to supplement the St. Lawrence Seaway Development Corporation's regular maintenance crews

Figure 6.--Aerial of Eisenhower Lock with downbound laker entering the lock chamber during navigation season. Saint Lawrence Seaway Development Corporation Photo.

Figure 7.--Crane placing final section of module for lock cover at Eisenhower Lock. Saint Lawrence Seaway Development Corporation Photo.

plus the employees of four contractors. The 1979-80 winter maintenance program cost nearly $2 million, with over $950,000 of this amount awarded to northern New York contractors and another $250,000 used to pay the temporary winter help.

The locks were "dewatered" by placing stop-logs, large gate-like constructions, in place upstream and downstream of the locks to serve as dams to hold back the river. This allowed the huge miter gates to be opened and closed for repairing and painting.

Once the stop-logs were in place and the water was out of the locks, previously assembled roofs were placed over the two lock chambers (fig. 7). This was no easy job considering that each of the locks is 800 ft long and 80 ft wide. The roofs were then insulated and sealed to prevent loss of heat while work was going on.

All the necessary equipment for this major repair program--stairways, scaffolding, heaters, and so on--had to be lowered 80 ft down to the bottom of the lock chambers (fig. 8). Six days later both locks were completely covered. Then the real work could begin.

Valves and gates were sandblasted and painted, cables were replaced, eight wire ropes on the vertical lift gate were replaced, and new wire rope was placed on the fender booms at each lock. These booms, also called ship arresters, keep a ship from hitting the downstream gates as it enters the lock chamber.

As is done every year, core samples were taken to locate deteriorating concrete in both locks. The weak concrete was removed and replaced. The old, deteriorated concrete is removed with air hammers and replaced with new reinforced concrete (fig. 9). The core samples used to monitor the condition of the concrete can be 4 in across and as long as 4 ft.

Emphasis was placed on lock machinery maintenance. A lot of work went on outside the locks as well. More than 200 floating navigation aids, or buoys, in the American waters of the Seaway were hauled out, repair-

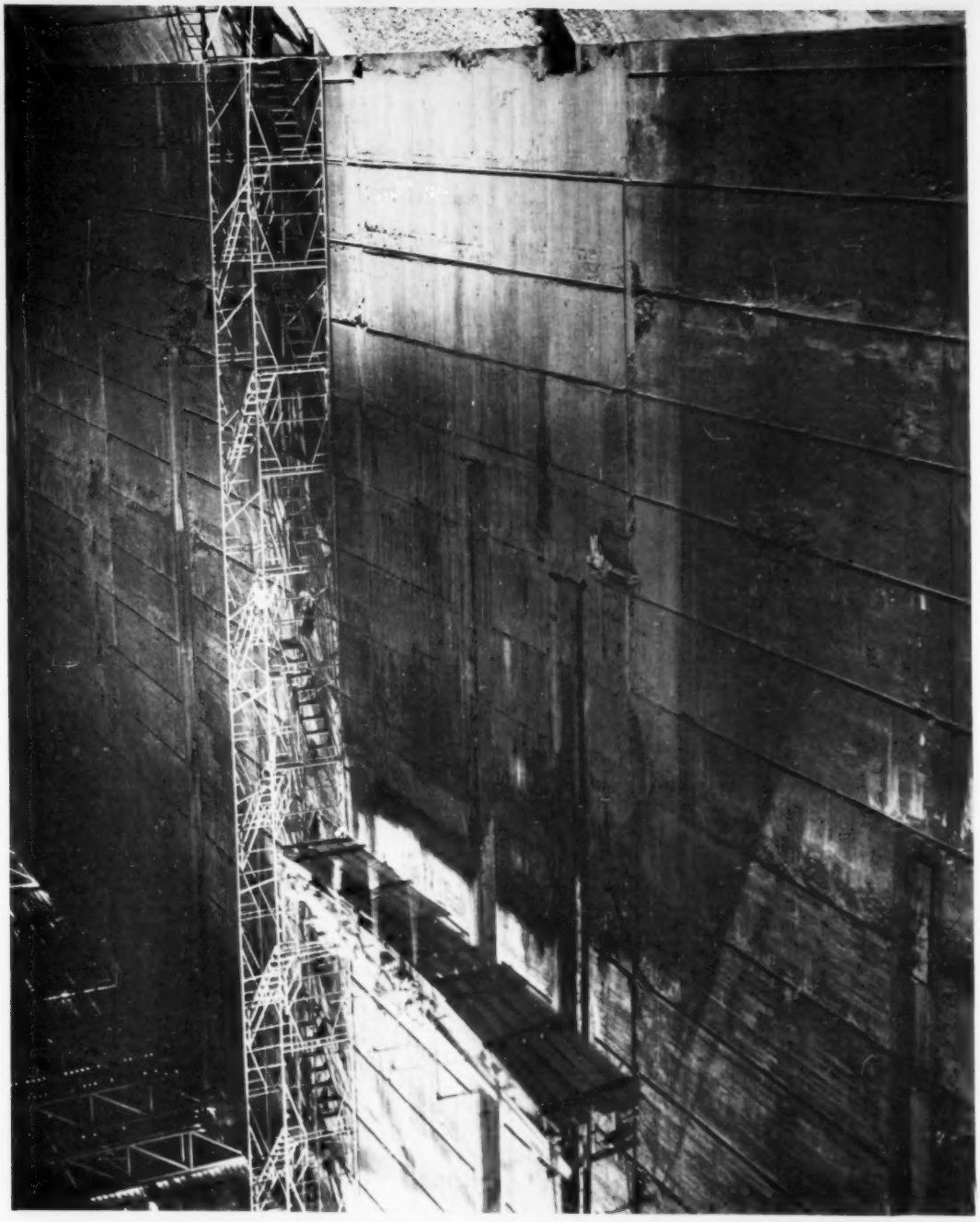


Figure 8.--Stairways and scaffolding in place in lock chamber for work on monoliths. Saint Lawrence Seaway Development Corporation Photo.

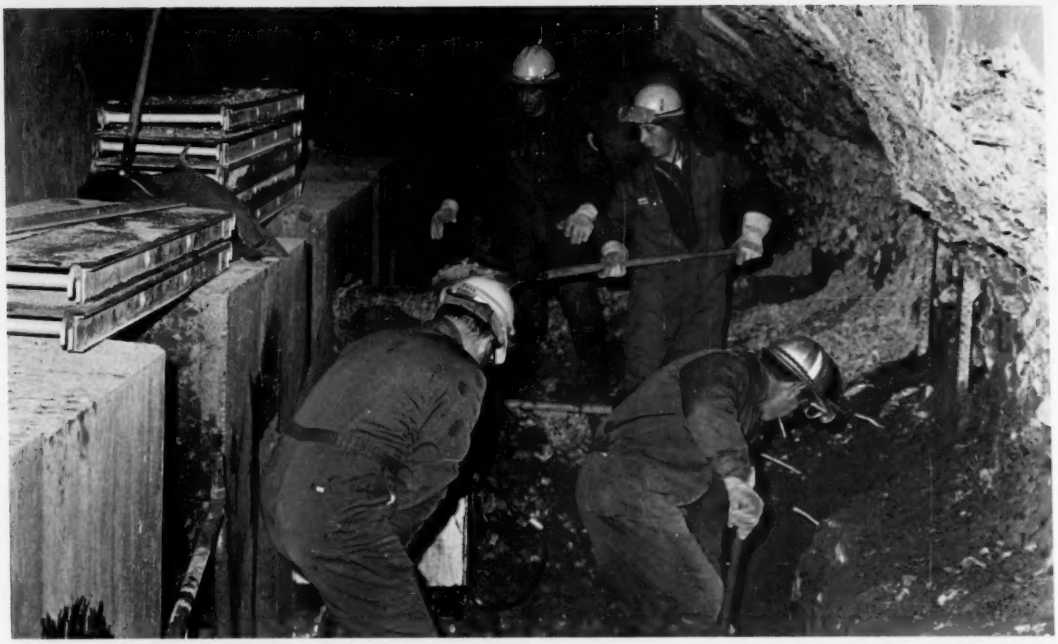


Figure 9.--Seaway operations' crews join regular maintenance crews during non-navigation structural repair and winter maintenance projects. Saint Lawrence Seaway Development Corporation Photo.

Figure 10.--Maintenance work completed on schedule--roof modules removed and lock machinery inspected prior to beginning of navigation. Saint Lawrence Seaway Development Corporation Photo.

ed if necessary, and painted. Towers for the permanent navigation aids were built and readied for spring installation.

Inside the vessel traffic control center, all equipment was inspected and repaired. Uninterrupted communication with the first ship of the year--and all the ships that follow--is vital.

All the vessels in the Seaway Corporation's fleet were overhauled. This included the machinery in the busy tug, ROBINSON BAY. A familiar sight on the Seaway, the ROBINSON BAY routinely breaks ice to open a channel for the first ship through the Seaway. All during the navigation season, whenever a ship has a problem that interferes with normal traffic patterns, she steams up or down the river to help.

The flushing port system at Eisenhower Lock was completed that year. This system was designed to flush ice from the lock chamber, where it accumulates in early spring and late fall. When ice can be flushed out of the lock, transit time for each ship is reduced, and there is no ice jammed in the lock to damage the ship's hull, the walls of the lock, or the mitre gates. Because of the magnitude of the work, the system was installed in three phases, beginning in 1976. This project is part of the Seaway Corporation's program to extend the navigation season.

During its first 20 yr as a marine link between the North American heartland and the trading nations of the world, the St. Lawrence Seaway-Great Lakes system has been used by nearly 125,000 commercial ships from 60 nations (fig. 10).

"The jointly-operated St. Lawrence Seaway has more than lived up to its potential as a major international trade route," says D.W. Oberlin, Administrator of the Seaway Corporation. "Keeping the waterway competitive, reliable, safe, and efficient is our top priority."

THE MARINERS WEATHER LOG WELCOMES ARTICLES AND LETTERS FROM MARINERS RELATING TO METEOROLOGY AND OCEANOGRAPHY, INCLUDING THEIR EFFECTS ON SHIP OPERATIONS.

Hints to the Observer

SUPERSTRUCTURE ICING AND SEA ICE

No shipmaster or ship's personnel need be told of the problems or hazards that sea ice or superstructure icing may present. The 1974 International Convention for Safety of Life at Sea specifies that ship masters are bound to report to the closest shore station incidents of gale-force winds causing severe ice accretion on superstructures and the occurrence of dangerous sea ice, including icebergs. Provision is made in the International Ship Code for reporting ice conditions in "code" or plain language. Coded language is used for the ice accretion group ($2I_SE_SE_SR_S$) and coded or plain language may be used for the sea ice group (ICE c_2KD_ire). When observed, either or both groups are added to the ship's code and to Form 72-1 in column 40. For an explanation of the coded symbols see Chapter 10 of Weather Service Observing Handbook No. 1.

Little can be said about sea ice except that ships involved in high- and midlatitude operations should see the series of articles on Sea Ice appearing in the November 1973 and July 1974 issues of the Mariners Weather Log.

Superstructure ice accretion is a complex process that depends on sea conditions, atmospheric conditions, and the ship's size and behavior. Icing can be caused by heavy sea spray, freezing rain, or fog.

Freezing sea spray is by far the most common and dangerous form of icing. It can occur when the air temperature falls below the freezing temperature of seawater (usually about -2°C) and sea-surface temperatures are below about 5°C. If air temperature falls below about -18°C, wind-induced spray may freeze before striking the ship and not adhere. In general, however, the lower the temperature and the stronger the wind, the more rapid the accumulation of ice. The spray generated by the ship herself is added to the spray blown from the wavecaps, so that the total rate of accretion of ice will also depend on the design and loadings of the ship (especially large deck loads), on her heading and speed relative to the waves, and also on the relative wind (which will determine which part of the ship is most exposed). It should be noted that an accumulation of ice will itself increase the rate of accumulation, because the ice already formed increases the effective cross section of rigging, mast, rails, etc., exposed to the spray (fig. 11).

A ship can also encounter icing in freezing rain or a type of fog often called "steam fog." Freezing rain can coat a ship with a freshwater glaze ice the same way it covers trees and roads on land. The weight picked up is usually not enough to endanger a ship, but this ice can make topside conditions dangerous. Steam fog can occur when the air temperature is below freezing and is also considerably colder than the sea. It is usually confined to a layer a few feet thick. Trawlermen call it "white frost" when the top of the layer is below the observer's eye level and "black frost" when it extends above the observer. The small water droplets in this fog are supercooled (exist as water even though the temperature is below freezing) and freeze on contact with the cold ship. Usually, ice accretion by this method is small. However, there are exceptions. The ERNEST HOLT, about 100 mi east of Bjørnøya Island (an island north of Norway) and 20 mi from the ice edge, ran into a dense steam fog. She took 4 in of rime ice on the deck, with up to 12 in on the ship's side at the level of the rail, within a 12-hr period.

Tests by Russians, Japanese, and British have shown that when air temperatures are just below the freezing point of the seawater, ice buildup is slow, and it will not accumulate at more than 1 ton per hour on a 300- to 500-ton vessel, in any wind. On a vessel of this size, a moderate buildup of less than 4 tons per hour will generally occur with air temperatures between -3°C and -8°C, in winds of 16 to 30 kt. When winds exceed 30 kt and temperatures drop below -8°C, conditions are right for an accumulation rate of more than 4 tons per hour on a 300- to 500-ton vessel.

A ship's own observations are a way to check on the threat of icing. If icing is encountered, the buildup rate is a tipoff as to the severity. A rate of up to 3 in per hr can usually be tolerated for a short period. Anything greater than this can quickly create stability problems. For more information, see the article, "Superstructure Icing," in the January 1974 issue of the Mariners Weather Log.

Tips to the Radio Officer

Tom Reppert
National Weather Service, NOAA
Silver Spring, Md.

The Canadian Coast Guard Radio Station at Halifax, Nova Scotia, is now providing radiotelex service as follows:

Selcal Number 1.0 0580

Transmit (kHz)	Receive (kHz)
4353.0	4173.5
6497.5	6259.5
8716.5	8355.5
13090.5	12510.5
17212.5	16675.5
22590.0	22221.0

Broadcast Service

Time (GMT)	Frequency (kHz)
0730/1600	8716.5
2120	4353.0

Figure 11.--The good old days? Crewmen battle tons of ice sheathing caused by freezing spray on the USCGC OWASCO during patrol on Ocean Station "Bravo" in the stormy Labrador Sea. This severe icing condition was threatening to get out of hand and endanger the ship's stability. U.S. Coast Guard Photo.

Broadcast content will be weather synopsis and forecasts for Nova Scotia and southern Newfoundland and coastal waters, Grand Banks, and Georges Bank. Ice reports for the Gulf of St. Lawrence are included in season.

CORRECTIONS TO WORLDWIDE MARINE WEATHER BROADCASTS (JUNE 1980 EDITION)

Page 9

1-0220 Tampa, FL WPD
Delete 8473, insert 8615.5.

Page 10

1-0260 Galveston, TX KLC
Add tropical outlook for the Atlantic, Caribbean, and Gulf of Mexico.

Page 17

1-0690 Rio de Janeiro PPR
Radio officer reports that station has discontinued weather broadcasts.

1-0701 Belem, Brazil PPL
Delete times and frequencies, insert:

0130, 0800, 1930	4265
	8502
	12979.5

1-0702 Juncao, Brazil PPJ
Delete times and frequencies, insert:

0130, 0730 1900	4251
	8460
	12689.5
	16918

1-0703 Olinda, Brazil PPO
Delete frequency 17162.

Page 19

1-0770 Pt. Reyes, CA NMC
Area C, change to read: Offshore areas 1 through 5.

1-0780 San Francisco, CA KFS
Area C, change to read: Coastal waters, areas 5, 6, and 7.

1-0790 Los Angeles, CA KOK
Area B, change to read: Coastal waters, area 8.

1-0810 Long Beach, CA NMQ
Previously deleted. Broadcast is now keyed from Pt. Reyes at the times and frequency listed. Change call sign to NMC.

Page 20
1-0945 Guam, Marianas Islands NRV
Area: (a) Marianas, Caroline and Marshall Islands; Ocean area Equator to 25°N, 130°E to 180°
(b) North Pacific Ocean west of 180°
(c) South Pacific Ocean west of 180°
(d) Indian Ocean

0100, 0800	466	F^2
0300, 1300, 1700, 2200	4955	$F^{235}{}_{W}{}^{345}$
	8150	
	13380	
	21760	

1. Broadcast also transmitted by San Miguel, Philippines (NPO)
2. For area a
3. For area b
4. For area c
5. For area d

Page 21
1-1020 Moji, Japan JNR
Delete times, insert 0955, 2150.

Page 22
1-1160 San Miguel, Philippines NPO
Area: (a) Marianas, Caroline and Marshall Islands, Ocean area Equator to 25°N, 130°E to 180°
(b) North Pacific Ocean west of 180°
(c) South Pacific Ocean west of 180°
(d) Indian Ocean

0300, 1300, 1700, 2200	4445	
	10440.5	
	12867	
	15925	

1. Broadcast also transmitted by Guam (NRV)
2. For area a
3. For area b
4. For area c
5. For area d

Page 23
1-1180 Dalian, P. R. C. XSZ
Delete time 1250, insert 1050.
Delete frequency 6502, insert 6333.5.

1-1210 Kaohsiung, Taiwan XSW
Delete frequency 460, insert 448.

Page 29
1-1570 Djibouti, Afars and Issa
Area:[1] Indian Ocean north of 10°S and west of 60°E, Red Sea and Gulf of Aden.

On request (0600-1500)	464^2	F
0430, 0900, 1700	8682^3	F

1. See figure 20
2. For areas D05, D15, D20
3. For areas A00 to A25

Page 107
Figure 13. Correct spelling of western Japan forecast area to read: "Fukuoka" vice "Sukuoka."

ACKNOWLEDGMENTS

Thanks to A.R. Facchinetti, SS PAUL L. FAHRNEY; Harry O'Brien, SS SHIRLEY LYKES; and Myron Kerner, NWS Communications Specialist, for recent information relative to the marine weather program.

Marine Observations Program

J.W. Nickerson
National Weather Service, NOAA
Silver Spring, Md.

This is a new section of the Mariners Weather Log dedicated to the marine observer. It will be prepared by the Marine Observations Program (MOP) of the National Weather Service, NOAA.

The major program of MOP is the Cooperative Ship Program (CSP), which is locally administered by the Port Meteorological Officers (PMOs). There are 13 PMOs located at ports in the Great Lakes, the U.S. East, Gulf, and West Coasts, and in the Republic of Panama. Please address your comments, questions, and gripes to me. My address is Marine Observations Program Leader (W521x2), National Weather Service, NOAA, Silver Spring, MD 20910.

We invite all observers to participate in this column. In coming issues we plan to present articles on instruments, observing techniques, weather codes, questions from observers, articles from observers, and news of interest to the observer.

Photographs of weather conditions, clouds, waves, or unusual phenomena are particularly desirable for making an interesting presentation. Photographs cannot be returned.

PMOS HOLD CONFERENCE

The PMO meets your ship and acts as the liaison officer between the marine community and the National Weather Service. Periodically we meet among ourselves to exchange experiences and to be briefed on the latest developments in various agencies having an affect on the PMOs or the marine community (fig. 12).

Figure 12.--PMO Conference and Workshop Participants, October 20 to 24, 1980, Silver Spring, Md. Left to right. Front row (seated): William E. Eggert, Chief, Data Systems Division, NWSH; Jerome W. Nickerson, Marine Observations Program (MOP) Leader; Martin Baron, MOP Statistical Programming. Second Row: E. Ray Brown, PMO , Norfolk, Va.; James H. Mullick, PMO, San Francisco-Oakland, Calif.; Douglas L. Davis, Chief, Observations Branch, Southern Region; Robert Melrose, PMO, Republic of Panama; Robert Baskerville, PMO, New York, N.Y.; Julius L. Soileau, PMO, Houston, Tex.; Peter Connors, PMO, Jacksonville, Fla. Third Row: Felex V. Flora, Marine Observations Specialist, Alaska Region; Frederick H. Day, PMO and OIC, WSO, Sault Ste. Marie, Mich.; Geoffry T. Meek, PMO, A.E.S., Toronto, Ontario, Canada; Charles Schlott, PMO, Newark, N.J.; David R. Lamb, Chief Observations Branch, Western Region; Anthony E. Rippo, PMO, Los Angeles, Calif.; H. David Shawley, PMO, New Orleans, La.; William Kennedy, PMO, Cleveland, Ohio. Fourth Row: Don Olson, PMO, Seattle, Wash.; Walter Sitarz, PMO, Maimi, Fla.

This year's conference was held in Silver Spring, Md., October 20 to 24. Only a thumbnail sketch of the presentations will appear here, but you may wish to discuss some subjects in more detail with the PMO at your next port visit.

We began with a PMO roundtable. The PMOs fired a couple broadsides at headquarters for effect. They also did a pretty good job of bringing up the gripes of the mariners. But, because of the scatter of the subjects covered, I wonder if we have a complete picture of the mariner's weather service requirements. We have very limited resources in the MOP, so we must choose carefully which problem to attack first. I would like to hear from you, the weather observer on our Cooperative Ship Program ships. What do you find good and bad about the CSP? What can we do better? What subjects from the following summary would you like covered more in depth?

The Marine Weather Services Branch, which is responsible for filling the mariner's requirements for forecasts and warnings, outlined the various products available. National Weather Service and Coast Guard communications were also covered in several presentations, including satellite communications.

The end of the line for the ship weather observations is the National Climatic Center (NCC). We had speakers from several departments that explained how part of the data is received from the radio messages from the ships and part is received by mail. There have been several recent changes in these systems to improve marine forecasting and services to the ship observer. NOAA Form 72-1, Ship's Weather Observations, is now mailed to the PMO for preliminary review before going to NCC (discussed under separate heading). It is a little early to assess the impact on observation accuracy, but there are apparent improvements. NCC is developing a better system to get the record of the observation errors back to the PMO. This should assist the PMO in getting the proper training to each observer according to his individual needs.

NOAA and the U.S. Navy are planning to pool their resources to develop a program to monitor the temperature of the ocean from the surface to depths of several hundred meters. Some merchant ships are making expendable bathythermograph drops already. This effort will be expanded in the future. The oceans are a major

source of energy for weather systems. To do long-range weather forecasting and global climate studies, the oceans must be included. This program will also lead to improved knowledge of ocean currents, storm developments, and tracks, which in turn will improve ship routing to save energy and avoid dangerous weather conditions.

The Maritime Administration speaker talked about the efforts of the National Maritime Research Center in developing new technology for improved operating economies through ship routing.

NEW SYNOPTIC WEATHER REPORTING CODE

On January 1, 1982, a new weather reporting code will be initiated. Actually, there isn't much that is new as far as the observation goes. Most changes are in data arrangement. By changing the arrangement of the data, the World Meteorological Organization (WMO) has been able to replace all of the various ship and land synoptic codes with a single code. The new code will be titled FM 13-VII Ship.

The advantages of the new code are many:

- One code worldwide at both sea and land stations.
- Only two new symbols, all others are the same as those now being used.
- The FM13-VII Ship code has various sections to easily identify data, even if part of the message is garbled.
- Various groups may be dropped entirely without loosing the other data.
- Provision for reporting only the elements of a group that are observed.

Even at first reading the change doesn't appear to be much of a problem. Almost all of the elements are the same as what you are now using. The advantages to the ships far outweigh the temporary inconvenience of learning the new places to enter the data.

We are working on the new observation instruction manual, ship code cards, and recording forms. If you have gripes about the old material or ideas for improving the new material let us know.

Code Sections

The FM 13-VII Ship code is divided into three sections:

Section 0 - Identification
Section 1 - Common to land and sea stations
Section 2 - Marine data

Section 0

All ships must include this section in their reports. Although the order of the elements is different, the observation elements used are the same as they are now.

$$M_iM_iM_jM_j \quad D...D \quad YYGGi_w \quad 99L_aL_aL_a \quad Q_cL_oL_oL_oL_o$$

Section 1

There are three general forms which indicate various degrees of completeness of the observation. Note that because the groups are now identified by number, there should be no confusion when a particular group or element within a group is dropped.

Full Form

$$i_Ri_xHVV \quad Nddff \quad 1s_nTTT \quad 2s_nT_dT_dT_d \quad 4PPPP \quad 5appp \quad 6RRRt_R \quad 7wwW_1W_2 \quad 8N_hC_LC_MC_H$$

Abbreviated Form

$$i_Ri_xhVV \quad Nddff \quad 1s_nTTT \quad 4PPPP \quad 7wwW_1W_2 \quad 8N_hC_LC_MC_H$$

Reduced Form

$$i_Ri_x/VV \quad Nddff \quad 1s_nTT/ \quad 4PPP/ \quad 7wwW_1W_2$$

The two new elements of the first group in this section are defined in the new code tables 1819 and 1860 (below). We are going to discuss each group and element of the new code in future editions of the Mariners Weather Log. There will also be new observing manuals and ship weather observation recording forms. These will be issued to you automatically, well before they are needed.

New Code Table 1819

i_R - Indicator for inclusion or omission of precipitation data

Code Figure	Precipitation Data are Reported:	Group 6RRRt$_R$ is:
1	in Section 1	included
2	in Section 3	included
3	in none of the two Sections 1 & 3	omitted (precipitation amount = 0)
4	in none of the two Sections 1 & 3	omitted (precipitation amount not available)

New Code Table 1860

i_x - Indicator for type of station operation and for present and past weather data

Code Figure	Type of Station Operation:	Group 7wwW$_1$W$_2$ is
1	manned	included
2	manned	omitted (no significant phenomenon to report)
3	manned	omitted (not observed data not available)
4	automatic	included
5	automatic	omitted (no significant phenomenon to report)
6	automatic	omitted (not observed, data not available)

Section 2

222 is the section identifier.

Full Form

$222D_sv_s$ $Os_nT_wT_wT$ $2P_wP_wH_wH_w$ $3d_{w1}d_{w1}d_{w2}d_{w2}$ $4P_{w1}P_{w1}H_{w1}H_{w1}$ $5P_{w2}P_{w2}H_{w2}H_{w2}$

$6I_sE_sE_sR_s$ ICE + plain language, or $c_iS_ib_iD_iz_i$

Abbreviated or Reduced Form

222// $6I_sE_sE_sR_s$ ICE + plain language, or $c_iS_ib_iD_iz_i$

Hurricane Alley

Dick DeAngelis
Environmental Data and Information Service, NOAA
Washington, D.C.

GLOBAL TROPICAL CYCLONES
NOVEMBER AND DECEMBER 1979

Twelve storms roamed the world's tropical oceans in this 2-mo period (fig. 13). Four of these were hurricanes. The western North Pacific and South Indian Oceans were the most active, with eight storms between them (table 1). They also had the most powerful storms. In the western North Pacific, typhoon Vera in November generated 140-kn winds around a 915-mb center. This supertyphoon followed on the heels of supertyphoon Tip. Unlike Tip, however, Vera moved through the Philippines. In December Claudette-Viola came to life in the South Indian Ocean. On the 19th her winds reached a peak of 115 kn. Several days later she moved through the Mascarene Islands. On Mauritius, thousands of houses were destroyed, while sugar cane and other crops were devastated. Gusts to 135 kn were estimated.

Activity during this 2-mo period was slightly below the normal of 12 tropical cyclones, 5 of which reach hurricane strength. Much of the blame lies with the Australia-South Pacific region, usually the most active basin. However, only tropical storm Ofa was spawned this year.

Table 1.--Global tropical cyclone summary, November and December 1979

No.	Name	Peak Intensity	Est. max wind (kn)	Basin	Dates
1.	Vera	H	140	W. North Pacific	Nov. 2-7
2.	Wayne	T	50	W. North Pacific	Nov. 8-13
3.	25-79	T	40	North Indian	Nov. 13-17
4.	Jimena	T	55	E. North Pacific	Nov. 15-18
5.	26-79	T	35	North Indian	Nov. 23-25
6.	Albine	H	85	South Indian	Nov. 25-Dec. 6
7.	Abby	H	110	W. North Pacific	Dec. 1-15
8.	Ofa	T	45	Aust.-S. Pacific	Dec. 8-14
9.	Claudette-Viola	H	115	South Indian	Dec. 10-25
10.	Bernice	T	35	South Indian	Dec. 15-21
11.	Ben	T	60	W. North Pacific	Dec. 20-23
12.	Danitza-Wilf	T	55	South Indian	Dec. 24-Jan. 2

TROPICAL CYCLONE WATCH - 1980

The tropical cyclones that have developed through December 1980 appear in table 2. This list must be considered preliminary, since we occasionally miss a storm in the Southern Hemisphere.

SOUTH INDIAN OCEAN
SEPTEMBER AND OCTOBER 1980

One storm developed during this 2-mo period. This is not unusual as tropical activity in the Southern Hemisphere is often infrequent until November or December. This system (21-80) developed some 400 mi west of the

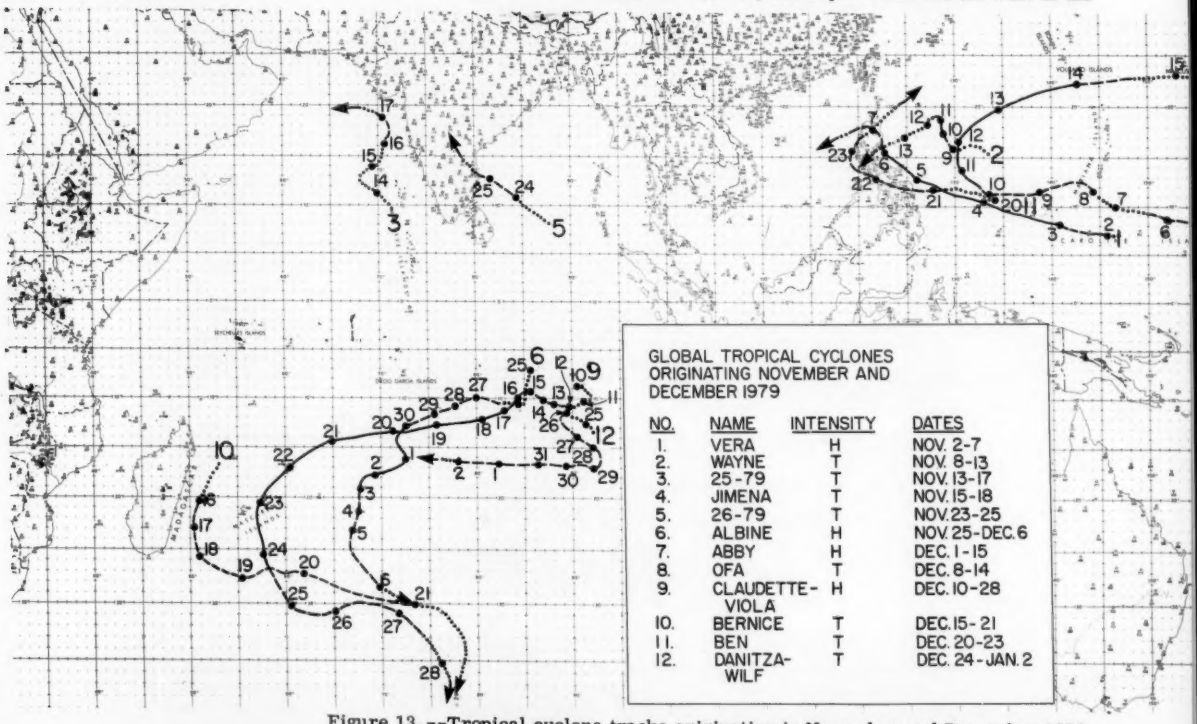


Figure 13.--Tropical cyclone tracks originating in November and December 1979.

Table 2.--World tropical cyclone watch, 1980

Eastern North Pacific		
Agatha	H	June
Blas	T	June
Celia	H	June
Darby	T	July
Estelle	T	July
Frank	T	July
Georgette	H	July
Howard	H	July
Isis	H	Aug.
Javier	H	Aug.
Kay	H	Sept.
Lester	T	Sept.
Madeline	T	Oct.
Newton	T	Oct.

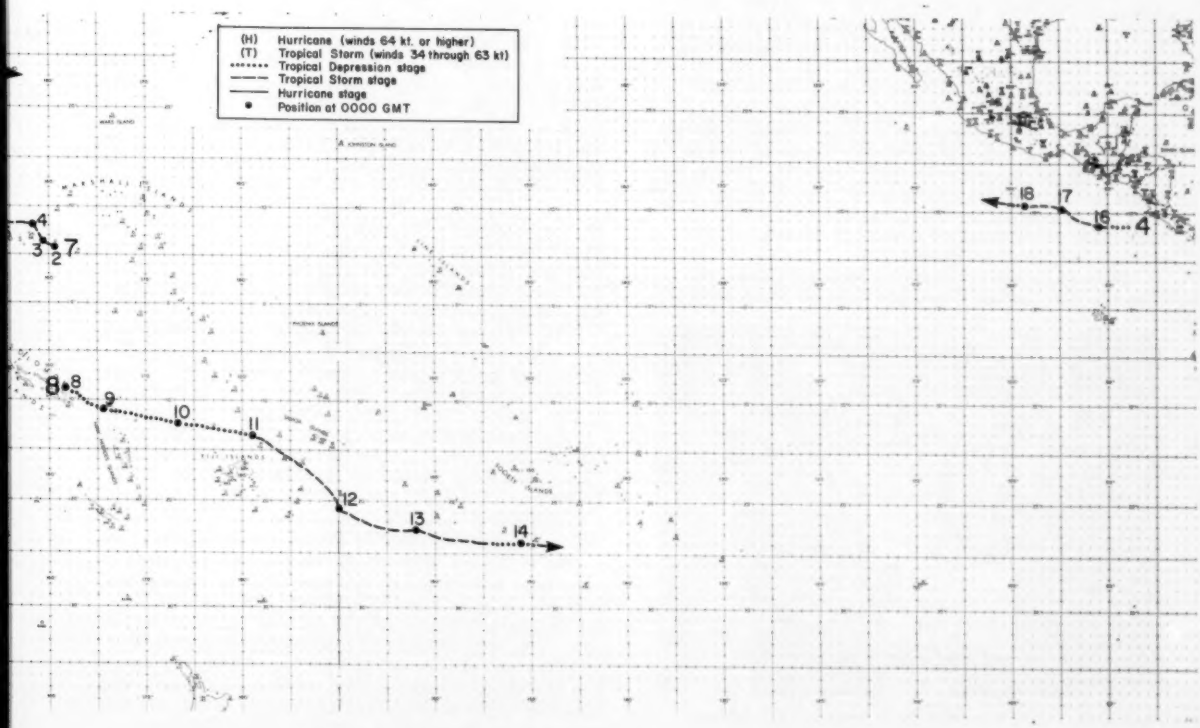
Western North Pacific		
Carmen	T	April
Dom	H	May
Ellen	H	May
Forrest	T	May
Georgia	T	May
Herbert	T	June
Ida	T	July
Joe	H	July
4-80	T	July
Kim	H	July
Lex	H	July
Marge	H	Aug.
Norris	H	Aug.
Orchid	H	Sept.
Percy	H	Sept.
Ruth	H	Sept.
Sperry	H	Sept.
Thelma	T	Sept.
Vernon	H	Sept.
Wynne	H	Oct.
Alex	T	Oct.
Betty	H	Oct.
Cary	T	Oct.
Dinah	H	Nov.
Ed	T	Dec.

Australia-South Pacific		
Peni	T	Jan.
Amy	H	Jan.
Paul	T	Jan.
Brian	H	Jan.
Dean	H	Jan.
8-80	T	Feb.
Enid	H	Feb.
Fred	H	Feb.
Simon	H	Feb.
Sina	H	March
Doris	T	March
Gloria	H	March
Tia	T	March
Val	T	March
Wally	T	April
Carol	H	Dec.
Felix	H	Dec.

North Indian		
23-80	T	Nov.
27-80	T	Dec.

South Indian		
Hyacinth	H	Jan.
5-80	T	Jan.
Jacinthe	H	Feb.
Kolia	T	Feb.
Laure	H	March
15-80	T	March
21-80	T	Oct.
Alice	H	Nov.
24-80	T	Nov.
Bert	H	Nov.

North Atlantic		
Allen	H	July
Bonnie	H	Aug.
Charley	H	Aug.
Danielle	T	Sept.
Earl	H	Sept.
Frances	H	Sept.
Georges	H	Sept.
Hermine	T	Sept.
Ivan	H	Oct.
Jeanne	H	Nov.
Karl	H	Nov.



Diego Garcia Islands on October 8 (fig. 14). The depression moved westward until the 10th, when it reached tropical-storm strength. It then traveled south-southwestward. According to satellite information, the system never developed beyond minimal tropical-storm strength. Maximum winds were estimated at 35 kn with gusts to 45 kn. By the 12th the system had crossed the 10th parallel near 61°E and headed southward as it weakened to depression intensity.

NORTH INDIAN AND AUSTRALIA-SOUTH PACIFIC REGIONS - SEPTEMBER AND OCTOBER 1980

These two regions were quiet during the period. This is not unusual for the Southern Hemisphere basin, where tropical cyclones are rare at this time of the year. However, in the North Indian Ocean, one or two storms are generally expected as the peak month of November is approaching.

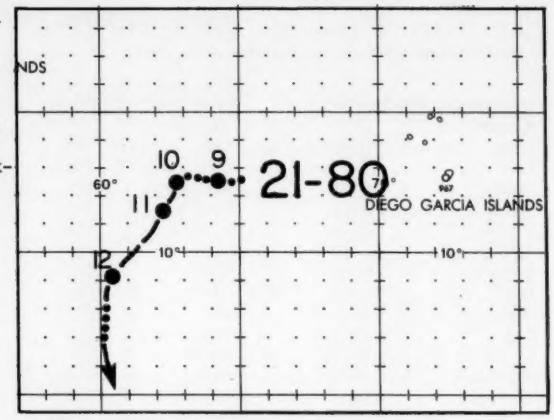


Figure 14.--Only one minor tropical storm developed in the South Indian Ocean during September and October 1980.

On the Editor's Desk

RETIRED CAPTAINS HONORED

Retired Interlake Captains William McSweeney and Leonard Olsen were recently honored by the National Weather Service in Cleveland, Ohio, for their many years of reporting weather conditions on the Great Lakes. Both men received a Special Service Award from William E. Kennedy, Port Meteorological Officer in Cleveland (fig. 15).

In presenting the citations, Kennedy noted that "Captains Olsen and McSweeney have ranked among the National Weather Service's most reliable weather reporters for the past 4 decades. We could always depend on the accuracy of their reports. When unusual meteorological conditions developed on the Lakes, Bill and Leonard immediately relayed all pertinent information to the Weather Service in Cleveland, thus making our job much easier."

Kennedy closed his remarks on a personal note. "People like Captain Olsen and Captain McSweeney have made my task an enjoyable one. It has been a real pleasure to know these men, both from a professional and personal viewpoint."

Figure 15.--Bill Kennedy (left) presents the Special Service Award to Captain McSweeney.

NTSB REPORTS ON CHEVRON HAWAII

On September 1, 1979, the 810-ft American oil tankship CHEVRON HAWAII was struck by lightning, triggering an explosion and fire which killed 3 persons, injured 13 others, and caused $77 million in damages. The accident occurred while the 70,000-ton vessel was discharging cargo at the Deer Park, Tex., Shell Oil Company terminal on the Houston ship channel.

The explosion and fire sprayed burning debris about the terminal and a fragment from the hull of the CHEVRON HAWAII ruptured a petroleum tank on shore which exploded and burned. The fire from the CHEVRON HAWAII also spread to four barges in a nearby berthing slip, and three of them exploded and sank.

The disaster claimed the lives of one crewman and two radar repairmen aboard the CHEVRON HAWAII. Damage to the ship was estimated at $50 million, and damage to the terminal, barges and other vessels, and accident-related claims exceeded $27 million.

The Board determined the probable cause of the accident was "...the ignition by lightning of accumulated flammable cargo vapors on the deck of the CHEVRON HAWAII and the propagation of the resulting fire into a cargo tank through an open or improperly secured tank opening cover plate or ullage opening."

The explosion of the Shell Oil Company terminal petroleum tank on shore was caused by ignition of the contained ethyl alcohol when a heated projectile from the exploding vessel ruptured its roof and fell into the tank. The barge fires and explosions were caused when the waterborne cargo fire from the vessel spread into the barge slip and ignited the barge cargoes. Contributing to the accident was the failure to remove the barges from the slip with available tugs or towboats

and the failure to properly maintain the barges' cargo tank closures. Contributing to the loss of life was the lack of a safe gangway or brow between the vessel's crew accommodations and the cargo terminal facility.

In analyzing the accident, the Board said that lightning ignited petroleum vapors on the forward deck of the CHEVRON HAWAII. The burning vapors propagated through an opening, or openings, in the deck to ignite flammable vapors in a forward cargo tank and caused the tank to explode. If the vessel had been equipped to smother explosive vapors in cargo tanks, the likelihood of an explosion would have been improbable. However, the Board noted that the Coast Guard is proceeding with regulations which would require inert gas systems on vessels similar to the CHEVRON HAWAII.

As a result of its investigation, the Board made several recommendations to the U.S. Coast Guard, the Shell Oil Company, and the Chevron Shipping Company. They also reiterated two earlier recommendations which had urged the Coast Guard to study the positioning of gangways to provide crews with a rapid escape from ships during emergencies, and to study safer means of escape from tankers when crews cannot use lifeboats or swim ashore.

Single copies of the Safety Board's complete printed report can be obtained without charge by writing to the Publications Branch, National Transportation Safety Board, Washington, D.C. 20594. Multiple copies may be purchased by mail from the National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161.

RIDLEY TO DIRECT NOAA OCEANOGRAPHIC DATA CENTER

Edward L. Ridley has been named Director of the National Oceanographic Data Center--a part of the Environmental Data and Information Service of NOAA. Ridley was formerly Chief, Marine Environmental Assessment Division of the Center for Environmental Assessment Services.

Ridley first entered the Federal Government as an oceanographer with the Naval Oceanographic Office in 1954. In 1961, he assumed responsibility for a marine science program to provide the Department of the Navy with marine environmental information to design, develop, and implement an underwater test range in the Tongue of the Ocean in the Bahamas.

In 1964, he was selected to manage a generalized oceanographic survey program that involved four ships and some 70 professional and support personnel. Subsequently, he was appointed Director of the Naval Oceanographic Office's Physical Oceanography Division, where he designed and implemented programs to monitor the extent of marine environmental degradation resulting from at-sea disposal of contaminated dredged material. These studies included field measurement programs and data interpretation and reporting.

In 1973, Ridley became Acting Director of the Naval Oceanographic Office's Ocean Sciences Department with responsibility to provide marine-related data to the Navy's fleet. This included a program of oceanographic measurements from aircraft and assessing the utility of observations from satellites in documenting oceanographic phenomena.

In 1978, Ridley transferred to the Environmental Data and Information Service where he managed a NOAA program of assessments of the impact of man's activities on the marine environment.

Ridley is an alumnus of St. Paul's College in Lawrenceville, Va., and also did graduate work in oceanography at Johns Hopkins University and the University of Rhode Island. His membership in professional and scientific societies includes the Marine Technology Society and the American Meteorological Society.

GREAT LAKES OBSERVATIONS, OCTOBER 1980

As the winter season approached the Great Lakes, many vessels were headed into lay-up and many more were being sold, some as scrap. Many of these vessels were weather reporting vessels. So, in order to give the forecasters at the five forecast offices an ample supply of observations, a rapid recruiting program began. The results for October 1980 were as follows.

Observations--47 United States vessels made a total of 2,055 observations and 95 Canadian vessels made a total of 1,638 observations for a grand total of 3,693 observations by 142 vessels. In addition, 526 3-hourly observations were made by Canadian vessels, and special observations were made at off synoptic hour times. Of the total observations, 3,432 were sent on the LAWEB.

Ship Reports--The greatest number of ship reports by U.S. ships was 82 on the 4th and the least number was 47 on the 11th. The greatest number of ship reports by Canadian ships was 69 on the 5th and the least was 39 on the 11th. There was an average of 27.7 observations on every LAWEB. The most ship reports on the LAWEB was 141 on the 4th (4 LAWEBS). The most on one LAWEB was 41 on the 24th and the least was 9 on the 26th.

The ships did a fine job of taking and transmitting the observations. NWS personnel did a fine job of getting so many ship reports on the LAWEBS. (Most of the ship reports that did not get on the LAWEB had errors in the report.)

WMO MARINE CLIMATOLOGY MEETING HELD IN ASHEVILLE

The National Climatic Center hosted a WMO Study Group Meeting on Marine Climatology during September 22-26, 1980. Delegates included experts from Japan, Hong Kong, the United Kingdom, Netherlands, Federal Republic of Germany, U.S.S.R. (two delegates), and the United States. Rob Quayle chaired the session, assisted by Marc Plantico, both of NCC. The WMO Secretariat in Geneva sent two representatives, one for translation and one for organizational assistance.

The Study Group was mandated by the Commission for Marine Meteorology's Working Group on Marine Climatology to:

1. Draft new surface marine exchange formats in accordance with the new WMO Code FM 13-VII SHIP which goes into effect January 1, 1982. These nonreal-time data are exchanged globally by over 40 maritime nations in order to accumulate a complete surface marine data bank for the World Ocean.

2. Draft new map formats for the Marine Climatological Summaries Scheme (Resolution 35, Congress-IV of the WMO). This project provides annual monthly surface marine summaries for the Globe for the period since 1961.

3. Review minimal quality control procedures for exchanged data.

4. Review progress on the Historical Sea Surface Temperature Data Project. This project, which is now virtually complete, provides data and summaries of high quality bucket sea-surface temperature, air temperature, and wind data globally for each year-month from 1860 to 1960.

5. Review programs which will provide guidance on use of telecommunicated data as a climatological resource.

A Draft Report is available in limited quantities from the NCC, Applied Climatology Branch. The Final Report will be published by the WMO in the near future.

SATELLITE SHOWS RECORD DIAMETER WARM CORE EDDY OFF HUDSON CANYON

In May 1980 a large anticyclonic warm core Gulf Stream eddy, 179 km in surface diameter, crossed west of 70°W into the slope water south of New England. By July 1980 the eddy (Atlantic Environmental Group label 79-H) was shown in satellite imagery to be southeast of Hudson Canyon (off New York-New Jersey) and was maintaining a 170-km surface diameter. Throughout June and early July the eddy entrained large encircling rings of cold shelf water from the north and warm Gulf Stream water from the south (fig. 16).

The eddy formed September 18, 1979, at 41.8°N, 63°W, with a surface diameter of about 125 km. It remained east of Northeast Channel (66°W) until late February 1980, when it began to travel south and then west along the Continental Slope. The eddy moved close to the Gulf Stream twice and entrained some Stream water at the surface, which led to an increase in diameter of the eddy. It touched the Gulf Stream near 39°N, 65.6°W, during March 5 to 12 and increased in diameter from 119 km to 170 km and again during April 4 to 11 near 39.5°N, 65°W, when it enlarged from 127 km to 187 km in diameter. The surface diameter had decreased to about 179 km by May 28, 1980, when 79-H moved into the slope water south of New England.

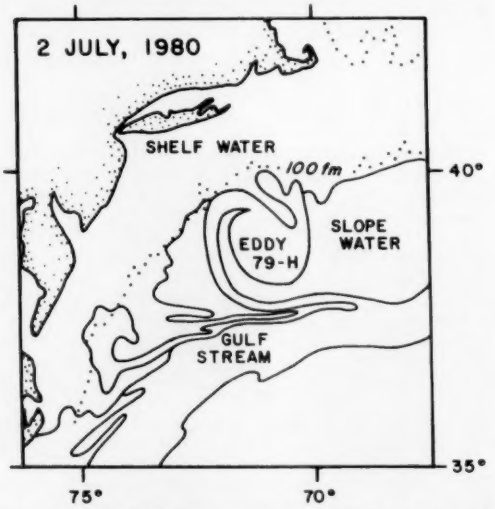


Figure 16.--Satellite interpretation of warm core eddy 79-H on July 2, 1980.

Eddy 79-H is the largest surface diameter eddy to enter the Hudson Canyon area during 6 yr of satellite observations. Usually large diameter eddies are resorbed by Gulf Stream meanders before reaching as far west as 70°W; however, during the 5-mo period when Eddy 79-H was moving along the southern slope of Georges Bank the Gulf Stream meandered at low amplitudes, the north wall remaining south of 38°N.

Eddy 79-H remained large as it moved through the Hudson Canyon area during July and August. On August 25 the eddy was centered at 38°N, 72.5°W, east of Baltimore Canyon and the Delmarva Peninsula. It finally dissipated in late October 1980 off Chesapeake Bay.

TSUNAMI INFORMATION AND DATA BASES

One of the most complex, catastrophic, and misunderstood natural disasters is that of the tsunami. These earthquake-generated waves have taken a tremendous toll of life and property. The Great Hoei Tokaido-Nankaido tsunami of 1707 claimed 30,000 lives and washed away 8,000 houses. More recently a tsunami originating in the Gulf of Alaska on March 27, 1964, resulted in $11 million property damage in Crescent City, Calif., in addition to the extensive damage in Alaska.

To help understand this phenomena, the National Geophysical and Solar-Terrestrial Data Center (NGSDC) and World Data Center A in Boulder, Colo., have compiled a set of data bases of direct interest to tsunami research and operations. These include digital and analog seismograms from a worldwide network and the derived information on epicenter, magnitude, and focal mechanisms; mareographic data from tide records; digital bathymetric data; and information on effects including a photographic file. The data center has a considerable capability in publishing and has printed catalogs on tsunamis in Alaska and Hawaii. It operates a modest guest worker program and can provide space, access to computers, digitizers, plotters and data files, and limited financial help to researchers who have need to access large amounts of data.

CALYPSO PHOTOGRAPHS EDMUND FITZGERALD

Ideal conditions prevailed on Lake Superior on September 24, 1980, which made it possible for the oceanographic research vessel CALYPSO to anchor above the EDMUND FITZGERALD. Divers spent 30 min on the bottom in CALYPSO's miniature submarine filming the wreck. Additional plans called for the CALYPSO to make sonar graphs of the wrecks along Long Point in Lake Erie and to visit the wrecks of the American war-

ships HAMILTON and SCOURAGE, which sank during a violent storm in 1813 near St. Catharines, Ontario, in Lake Ontario. The CALYPSO was built in 1942 in Seattle Wash., and is 138 by 25 by 11 ft.

AIRCRAFT MEASURES WIND FIELDS OFF WASHINGTON COAST

From February 12 to March 12, 1980, low-level wind fields off the Washington coast were surveyed by airplane in a variety of weather conditions.

Much of the coastal meteorology of the West Coast is dominated by the orography of the coastline. Onshore flow, impinging against mountains, can create a back pressure which modifies the wind field for a considerable distance seaward. Figure 17 shows a typical meteorological situation associated with the occurrence of so-called Gap Winds in the outer Strait of Juan de Fuca. An offshore low-pressure system, which is impinging upon a region of high pressure over eastern Oregon, Washington, and British Columbia, creates a strong east-west pressure gradient over western Washington and the coastal waters. The flow in the outer Strait is constrained by air stability and remains below the level of the mountains. The flow accelerates from high pressure to low pressure as it flows out the gap.

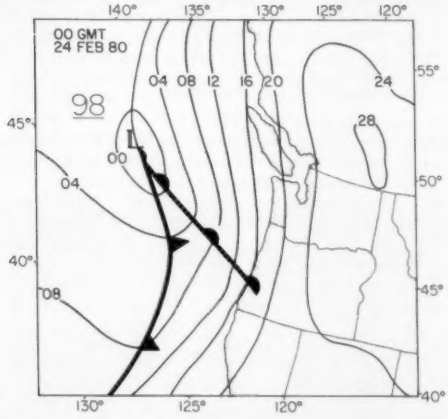


Figure 17.--Sea-level pressure analysis during the aircraft flight on February 23, 1980.

Figure 18.--Aircraft and shore station winds on February 23, 1980. Arrows show where the wind is coming from, with each long tail feather indicating 10 kn and each short feather 5 kn. Aircraft measurements were made at 50 m. Shore stations are circled and in heavy type.

An interesting feature of the low-level aircraft wind measurements (fig. 18) is that the east wind jet persists seaward with the maximum velocities observed from the aircraft 30 km offshore. Velocities measured at the shore station on the central Washington coast, which is well exposed, are not indicative of the offshore flow field beginning several kilometers from shore.

GULF STREAM ANALYSIS

The NOAA Satellite Field Services Station (SFSS) at Miami, Fla., recently introduced a new service designed to provide regional Gulf Stream System information to marine users with access to a telecopier device. The Miami SFSS prepares an analysis of the Gulf Stream System between Cape Hatteras and New Orleans from infrared satellite imagery and other data each Monday, Wednesday, and Friday. This analysis shows the edge of the warmer water that marks the shoreward side of the Stream, the offshore limit of the warmer water when detectable, meanders, eddies, and coastal water mass boundaries, as well as a streamline indicating the estimated location of the maximum current and, when available, actual observed current speeds. This analysis is prepared on an 11 in by 14 in chart. That portion of the chart that includes Florida and the Atlantic waters will be placed on an automatic telecopier (Xerox Model 410) everyday from 0100 to 0700 EST and again from 1300 to 1900 EST. That portion of the chart which includes Florida and the Gulf of Mexico waters will be placed on the telecopier everyday from 0700 to 1300 EST and again from 1900 to 0100 EST. Either or both portions of this Gulf Stream System flowchart may be obtained by calling 305-661-0738 during the appropriate time periods and acquiring it/them on your telecopier receiver. Questions regarding these analyses may be directed to the SFSS at 305-665-4707 or 305-350-4310, the latter being an FTS number as well. An oceanographer is normally on duty during the morning hours of weekdays, although calls may be answered also during the afternoons and on weekends.

The quality and completeness of these analyses depends upon ocean surface temperature contrasts and a lack of extensive and persistent cloud cover. Extensive overcast cloudiness for extended periods may preclude analysis in certain areas even during winter. During the warmer summer months, coastal water temperatures normally increase to nearly match those of the adjacent Stream, reducing detectable temperature contrasts. For this reason, the entire Gulf Stream System analysis may become very difficult or impossible around Florida and throughout the Gulf of Mexico from approximately early June to late October. Thus, these analyses for latitudes south of about 30°N may be discontinued during the summer.

Comments or suggestions regarding this new service will be welcomed. Please telephone or write to NOAA Satellite Field Services Station, 1320 South Dixie Highway - Room 619, Coral Gables, FL 33146.

PRINSENDAM RESCUE

The following article was taken from Rescue Review, published by Headquarters, Aerospace Rescue and Recovery Service, U.S. Air Force, Scott Air Force Base, Ill. It was written by SSgt. Andrew Flood, 21st Tactical Fighter Wing, Office of Public Affairs.

People and equipment from the Aerospace Rescue and Recovery Service (ARRS), Coast Guard, and Canadian Forces responded to a call for help October 4 and pulled off what the national news media described as the greatest maritime rescue in the history of the United States.

The daring operation began when an uncontrollable fire in the engineroom of the Dutch luxury oceanliner PRINSENDAM forced passengers and crew to abandon ship in the frigid and turbulent waters of the Gulf of Alaska.

All of the more than 500 people on board were rescued without serious injury during the mission that lasted all day and long into the night.

The PRINSENDAM was starting its ocean crossing on a voyage from Vancouver, British Columbia, to Singapore, when a fire broke out in the engineroom in the early morning hours.

Extinguishing failed and the blaze continued to spread, forcing the decision to abandon ship. The vessel was about 120 mi south of Yakutat, Alaska, at that time.

The initial distress call was received by the Coast Guard's Juneau Rescue Coordination Center, and the wheels began to turn.

Figure 19.--The HH-3 helicopter was highly effective in rescuing the PRINSENDAM survivors from lifeboats. U.S. Air Force Photo.

Juneau's RCC, seeing the enormity of the situation, contacted the Alaskan Air Command RCC at Elmendorf AFB near Anchorage and asked for assistance.

A HC-130 Hercules aircraft and HH-3 Jolly Green Giant helicopter (fig. 19) and crews from the 71st Aerospace Rescue and Recovery Squadron were soon launched from Elmendorf.

A flight surgeon assigned to Elmendorf's 43rd Tactical Fighter Squadron and five pararescue specialists

Figure 20.--The tanker WILLIAMSBURGH stands by to receive survivors. U.S. Air Force Photo.

from the 71st AARSq. accompanied the flight crews.

The first ship to respond to the call for help was the supertanker WILLIAMSBURGH (fig. 20) on its way out of Valdez, Alaska. When the first Coast Guard helicopters arrived, they began to airlift PRINSENDAM passengers from tiny lifeboats to the tanker.

Captain John Walters and his crew also flew their HH-3 helicopter to the tanker and made the first shipboard landing of their careers on the tossing deck of the vessel.

After they dropped off 169 blankets, the Air Force crew took off again to begin recovering survivors. From their helicopter hover 10 ft above the cold Alaskan waters, pararescue specialists SSgt. John Cassidy and Sgt. Jose Rios, dressed in full scuba suits, jumped into the choppy seas.

They swam with survival supplies and flares to the floundering lifeboat and began to assist passengers onto the lifeline that hoisted them up to the helicopter.

The PRINSENDAM's cruise photographer later said of the pararescuemen, "They came down and saved people's lives. They kept people calm and covered our boat with tarps."

Figure 21.--Smoke pours out of the bridge of the mortally wounded PRINSENDAM. U.S. Coast Guard Photo.

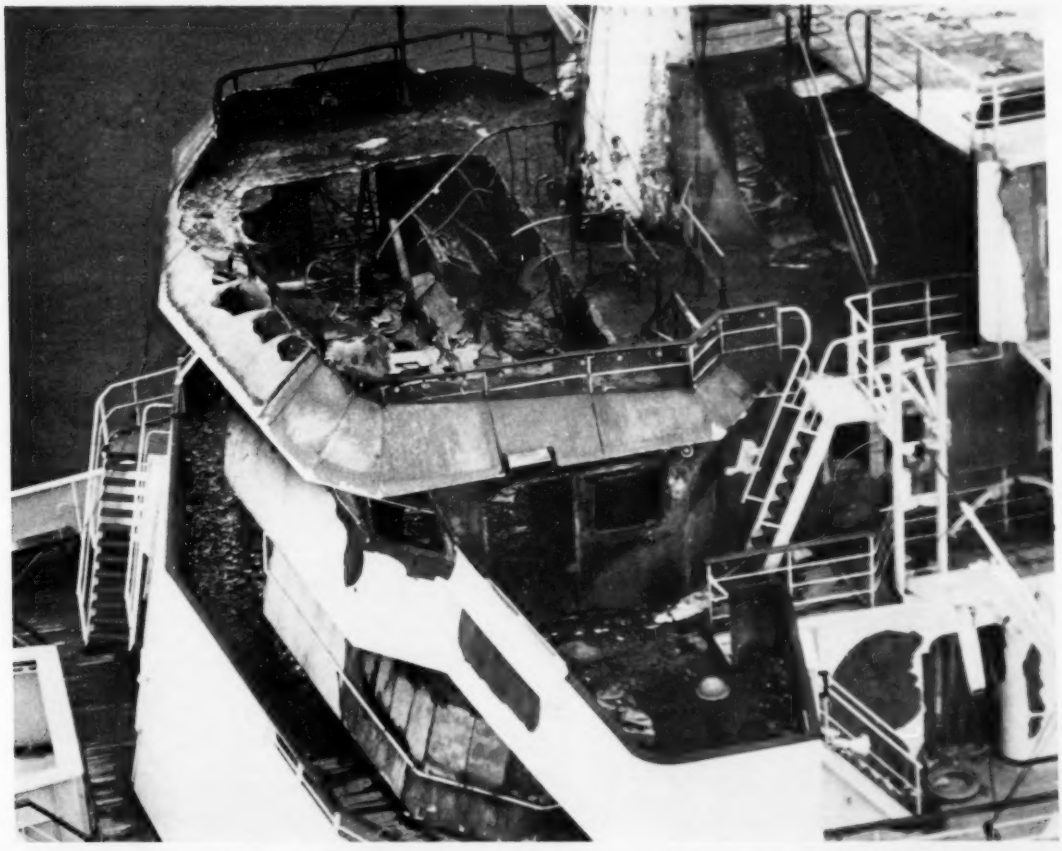


Figure 22.--A gutted bridge gives testimony to the heat generated by the fire. U.S. Coast Guard Photo.

The rescues from this particular boat were destined to be long in coming as other factors intervened.

As the PRINSENDAM fire raged out of control (figs. 21 and 22), the HH-3 crew was called away to the ship to evacuate the remaining 19 crewmembers to the WILLIAMSBURGH.

Also at the same time, a Canadian Forces CH-46 helicopter on its way to the rescue area developed electrical instrumentation problems. It was flying out over the Gulf with no guidance.

Captain Dave Briski and his HC-130 crew flew their aircraft with directional-finding equipment, search radar, and inflight refueling capabilities to search for the missing Canadian helicopter.

Up until this time, 42 passengers were evacuated from the lifeboat. Just 18 other people and the two pararescue specialists remained when the rescue aircraft were diverted.

The HC-130 crew found the Canadians and escorted them back to Yakutat.

At the PRINSENDAM, true to naval tradition, the last to leave was the ship's captain. He and the rest his crew were hoisted aboard the HH-3 and flown to the WILLIAMSBURGH.

There Captain (Dr.) Don Hudson, the 43rd TFS flight surgeon, and pararescue specialists SMSgt. Gene Nardi and SSgts. Dan Humphreys and Russell Tanner treated survivors. Together they were credited with 370 lifesaving assists.

Increasing winds and 20-ft sea swells hampered rescue operations as the HH-3 crew returned to the tiny lifeboat to continue the airlift.

Hoist cable slack caused by churning seas tangled the cable with the lifeboat rudder. Pitching and tossing, the boat dropped down with a wave and the cable "snapped like butter," according to Captain Walters.

With the weather continuing to deteriorate and the HC-130 diversion to assist the Canadian helicopter, Captain Walters was forced to suspend rescue efforts and make a landing on the rolling deck of the supertanker SOHIO INTREPID.

"With my flying gas station (the HC-130) gone, I was quickly running out of fuel, and if the INTREPID hadn't been nearby, we might have gotten wet," explained Captain Walters.

As it was, the weather had closed in to the point that the Coast Guard had to "paint" the HH-3 on its radar and treat it like a ship to guide it to the INTREPID.

Fortunately for the HH-3 crew, they managed to land on the deck of the wildly heaving tanker where their helicopter was secured for the night.

Back in the lifeboat Sergeants Cassidy and Rios made the best of a lonely situation.

Most passengers were in a state of shock. Damp and cold after 15 hr at sea, many wondered if they would ever be rescued.

"We pulled tarpaulin over the boat to keep the sea

Figure 23.--The Coast Guard Cutter MELLON shown above was diverted to the rescue scene. Her sister ship, the BOUTWELL, picked up the survivors in the missed lifeboat. U.S. Coast Guard Photo.

spray out and tried to cheer them up," recalled Sergeant Cassidy. "We kept telling them not to worry and assured them the helicopter would be back."

As night fell in the Gulf several passengers urged the pararescuemen to shoot their flares. However, years of experience and training told Sergeants Rios and Cassidy to save them until the right moment--when a ship or aircraft was in sight.

As the main rescue operation concluded, the Coast Guard began a head count to ensure that all passengers and crew from the PRINSENDAM and all rescue forces were accounted for.

With survivors scattered from Sitka, Alaska, to Valdez, and several ships still steaming toward port, the count was difficult at best.

When Air Force officials at the Elmendorf RCC began to account for their people in the operation, they came up two pararescue specialists short.

The Coast Guard cutter BOUTWELL and C-130 aircraft and crew from Kodiak, Alaska, were sent back to the PRINSENDAM area to search for more survivors and the two missing pararescuemen.

About 2:30 the next morning, some 18 hr after their ordeal began, Sergeant Cassidy saw a passing ship and used a hand-held night flare to attract its attention.

As the vessel's searchlight scanned the surrounding ocean, the sergeant used a survival mirror to bounce the light back to the BOUTWELL's deck (fig. 23).

The Coast Guard crew sighted the lifeboat and the last chilled, weary survivors and pararescuemen were taken aboard the boat.

According to Lt. Col. Bill Langley, 71st AARSq. commander, "There has never been a rescue like this one. It was an awesome effort."

Lt. Col. Eric Wheaton, 71st AARSq. director of operations, echoed these sentiments and added, "It's missions such as this one that make all the rigorous training pay off."

Sergeant Rios is assigned to the 41st AARSq., McClellan AFB, Calif. He was on temporary duty with the 71st AARSq. to receive training under arctic conditions.

Sergeant Cassidy is a veteran of about 60 rescue missions in Alaska as a member of the 71st AARSq.

Upon final count of the rescue operation, Captain Walters and his crew were credited with 61 saves. Captain Briski and the rest of his HC-130 crew were credited with four saves for the Canadian helicopter crewmen.

"Miraculously, no lives were lost during this massive rescue effort, a definite tribute to the professionalism and training of these crews," said Maj. Gen. Cornelius Nugteren, ARRS commander.

SPANISH SAIL POWER FOR VENEZUELA

A three-masted sail ship for the training of marine cadets--only the third such vessel to be constructed anywhere in the world in the last 20 yr--has been delivered to the Venezuelan Navy.

The SIMON BOLIVAR, whose total sail surface is about 1,500 m^2, is of Bergantinbarca design. Her hull is made of steel. She was built in Spain at Astilleros Celaya, Bilbao, and designed by Senermar, Spain's leading firm of naval architects, using Senermar's internationally established FORAN computer system for ship design and production.

The other two naval training sail ships to be constructed in the last 20 yr were the GLORIA for Colombia in 1968 and the GUAYAS for Ecuador in 1976. Both were designed by Senermar.

ABNORMAL PROPAGATION

The DART AMERICA on a passage from Halifax, Nova Scotia, to New York on July 15, 1980, received Virginia Pilots, Atlantic City Coast Guard, and Cape May and Chesapeake Light loud and clear on VHF Channel 16. The ship was near 43°N, 65°W, at 2200 on a course of 220° at 18 kn. The air temperature was 17.8°C, wet bulb 16.2°C, barometer 1014.1 and steady, wind south-southwest at 20 kn, 6 octas of clouds, and visibility 10 plus mi. The DART AMERICA was approximately 600 mi from the transmitter.

1980 HEAT WAVE TOOK 1,265 LIVES, COST $20 BILLION

This summer's heat wave and drought took at least 1,265 lives and cost the nation nearly $20 billion. NOAA's Environmental Data and Information Service reports that because of the high temperatures and dry conditions·

- Heat-related summer deaths were seven times greater than normal;
- Electrical energy use was 5.5 percent above normal, a reco d;
- Crops and livestock suffered greatly;
- Hundreds of miles of major highways buckled;
- Water resources in many parts of the country were seriously jeopardized.

The analysis is based on information obtained from federal agencies, private organizations, and 26 States affected by the unusual weather from June into September.

Most of those who died from the heat wave were either elderly or poor, and lived in nonairconditioned homes or apartments. The greatest number of fatalities, 311, occurred in Missouri, even though other States had higher temperatures for longer periods.

Authorities at NOAA's Center for Environmental Assessment Services said the heat wave's greatest impact on energy consumption and costs began during the last week of June and continued for 6 weeks thereafter. Electric use during the period averaged 5.5 percent above normal at an accumulated cost of more than $1.3 billion.

Corn, soybean, and next spring's wheat crops were damaged by the drought. The poultry industry also lost millions of birds. However, the winter wheat crop actually benefited from hot, dry weather during the harvesting period.

Parched pastures, poor nutrients, and the heat slowed livestock growth, resulting in widespread sell-off of herds. The destruction of the protective vegetative covers of thousands of acres of Midwest crop land also may cause severe soil erosion in winter months.

Because of the drought, the price of finished or ready-for-sale food items rose by 4.4 percent in August alone, while prices for raw agriculture products increased 19 percent during July and August.

The heat wave buckled hundreds of miles of major highways in South Central and Midwestern States, and softened asphalt highways in Texas and Arkansas, where surface temperatures exceeded 150°F. Illinois alone sustained $100 million in road damage. Highway damage throughout the heat belt is estimated at four to five times that amount. The heat is also blamed for widespread vehicle breakdowns and a surge in automotive repair expenditures.

Many areas had water shortages and rationed their supplies. Texas and Arkansas were the hardest hit. A drop in the water table in those states and Oklahoma forced farmers to "dry" farm acreage that previously was irrigated. The drop far exceeded yearly normals and also threatened industrial development.

The heat wave began in mid-June, when temperatures exceeded 100°F in southwest Texas. By the second week in July, it had spread northeastward with most of the central one-third of the nation experiencing 100-degree temperatures. In mid-July the heat wave spread eastward to the Ohio Valley and mid-Atlantic region and, despite several brief respites during the next few weeks, covered much of the eastern United States through the week ending September 7. On July 13 three cities broke their maximum temperature records: Augusta, Ga (107°F); Atlanta, Ga. (105°F); and Memphis, Tenn. (108°F). Temperatures in Dallas, Tex., reached 100°F each day from June 23 through August 3.

MARINE WEATHER REVIEW

The Smooth Log (complete with cyclone tracks, climatological data from U.S. Ocean Buoys, and gale and wave tables) is a definitive report on average monthly weather systems, the primary storms which affected marine areas, and late-reported ship casualties for 2 mo. The Rough Log is a preliminary account of the weather for 2 more recent months, prepared as soon as the necessary meteorological analyses and other data become available. For both Smooth and Rough Logs, storms are discussed during the month in which they first developed. Unless stated otherwise, all winds are sustained winds and not wind gusts.

Smooth Log, North Atlantic Weather

July and August 1980

SMOOTH LOG, JULY 1980--The cyclone tracks this month did not compare at all well with climatology. The tracks of the storms over Canada and the northern United States were very diverse. Very few managed to make the transition from continental to maritime. The most preferred track over water was from the Gulf of St. Lawrence to the North Sea. As the storms approached western Europe they tended to diverge. The primary climatological track and area of cyclogenesis off the U.S. East Coast did not exist. As expected in a summer month, the cyclones were weak.

The mean sea-level pressure pattern reflected the diversity and weakness of the maritime storms. The primary feature, of course, was the Azores High at 1028 mb. The center was near normally located at 35°N, 42°W. There was the usual ridging into the southeastern United States and western Europe. The European ridge was over the Mediterranean, farther south than usual. A usual slight ridge toward Greenland was accented and toward Iceland. The Greenland High, usually over the ice cap, spanned the Greenland and Barents Seas (fig. 24).

The normally weak low-pressure centers were displaced. The climatically strongest one was 1007 mb over Hudson Bay rather than Cape Chidley. The normal 1010-mb Low over Iceland was 1012 mb north of Ireland, and the normal 1010-mb Low over northern Sweden was 1011 mb over Denmark.

Although the pressure departures were not large,

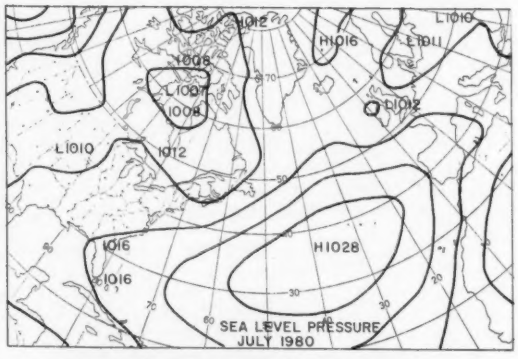


Figure 24.--Mean sea-level pressure.

they were significant in reflecting the cyclone tracks. There was a large elongated area of negative values across Europe between latitudes 50° and 55°N. There was a large positive area of up to 6 mb over the Greenland and Barents Seas.

In the upper air at 700 mb the primary Northern Hemisphere circulation center was shifted from the North Pole to over Devon Island in the Queen Elizabeth Islands. The east coast trough was shifted westward to Hudson Bay. A discontinuity occurred over

southern Canada, and the trough shifted to off the U.S. East Coast. The usual trough along longitude 10°W was accented by an anomalous High over the Gulf of Bothnia.

The first tropical cyclone, Allen, was a depression on July 31.

Extratropical Cyclones--The Azores High was a steady feature slightly southwest of the Islands, ocasionally drifting into Europe and splitting with a second center becoming the Bermuda High. There was the permanent heat Low over the Sahara.

The first storm came out of the Plains and traveled along the Canadian-United States border. The storm was 992 mb over the Gaspe Peninsula at 1200 on the 6th. Heavy rains were widespread, and the town of Grande Vallee was hard hit by flooding with damage estimated at over $1 million. The northeastern part of the Gaspe Peninsula was hardest hit. Power outages were not completely restored until the 8th. The first high-wind report was from a SHIP near 35°N, 73°W, of 52 kn in a thunderstorm along a trough line. The AMERICAN RANGER had only 28-kn winds, but swell waves were 25 ft near 38°N, 65°W. The RESOLUTE (39°N, 67°W) had 43-kn winds and 13-ft waves. At 1800 the SEA-LAND GALLOWAY, 350 mi south of the center, had minimal gales. The PROVO WALLIS at 44°N, 63°W, started the day with 47-kn westerly winds. The ATLANTIC PRELUDE was east of Halifax, Nova Scotia, within 4 mb of the storm's center with 50-kn winds. A ship south of St. Pierre had 20-ft swells from the south-southwest. A new LOW formed near the point of occlusion. On the 8th the FREDERICK CARTER near Sidney had 45-kn winds blowing through Cabot Strait. The NORTHWIND was 60 mi south of Kap Farvel and measured 40-kn winds with 13-ft seas. The new center was moving northward. The GRONLAND was just off Kap Farvel on the 9th with 44-kn winds from the east. The weather station was plotted as 45 kn. A ship called the seas 20 ft. The storm split on Kap Farvel with the eastern center surviving and moving eastward. No further gale reports were received, and the center reverted to a trough on the 12th.

This LOW was discovered north of Sept-Iles on the 16th. Cape Race and a Canadian ship just to the south both had 35-kn winds. Neither reported waves. The WVFN (47°N, 49°W) also had 35-kn gales on the 17th. By 0000 on the 18th the 1000-mb storm was at 54°N, 40°W. The C.P. DISCOVERER (56°N, 43°W) was northeast of the center at 0600 with 44-kn winds and 12-ft seas from the northeast. The storm was racing eastward and was over Scotland at 1200 on the 19th and was over the Skagerrak on the 20th. The northerly flow over the North Sea brought gales to the many ships and platforms there. The VULCANUS off Helgoland recorded 41-kn gales and the VENDEE off Brest had 40 kn. On the 21st most of the winds over the North Sea were in the upper 30's, but two reports in the vicinity of 56°N, 02°E, had 44 kn. The storm disappeared on the 22d.

Cape Race produced this storm on the 21st. Several stable waves had occurred along the front in that area, but this one was unstable and expanded. It raced eastward and at 1200 on the 23d was near 44°N, 29°W, at 990 mb. The AMERICAN CHALLENGER (44°N, 32°W) found 40-kn winds and 16-ft seas. The ALAIN L.D. (42°N, 34°W) reported 68-kn winds, which seemed high for the pressure gradient and season. Her seas were 20 ft, and there was rain in sight. Clouds were coded as cumulonimbus, so there were probably strong winds associated with these and the instability. The BISCHOFSTOR (41°N, 34°W) had 39-kn gales at 1800. At about that time the LOW must have passed nearly directly over the CAST PETREL. At 0000 on the 24th she had 41-kn northerly winds. Past weather indicated thunderstorms. Later in the day the WILD FLAMINGO (44°N, 19°W) had 45-kn winds and 25-ft waves. On the 25th OWS Romeo measured winds over 40 kn and seas as high as 25 ft. The storm was traveling northeastward and dissipated over the Irish Sea on the 26th.

Another unstable frontal wave formed east of Trinity Bay on the 24th. The AMERICAN ALLIANCE found 35 kn as the front crossed her path. At 0000 on the 26th both the DART AMERICA and DART CANADA were sailing westward in the storm. The AMERICA had 53 kn from the southeast, and the CANADA had 42 kn from the west accompanied by 20-ft swell waves. At 1800 the AMERICAN ACE (48°N, 27°W) was on the receiving end of 45-kn winds, and the SEA-LAND PACER (49°N, 22°W) had northeasterly 40-kn winds with 20-ft swells.

The storm was headed into the Bay of Biscay on the 28th, when it suddenly turned northward. OWS Romeo had 20-ft seas from the north. The storm weakened with the shift in direction, but it intensified again on the 30th. Several ships again reported gales. On August 1 the storm stalled until the 3d near 55°N, 25°W.

Tropical Cyclones--Hurricane Allen became a tropical depression on July 31 and thus will go down in history as a July storm. He will also be remembered as the strongest storm ever in the northwestern Caribbean Sea and for the second lowest measured pressure over the North Atlantic.

While Allen's presence was felt for about 9 days in the Caribbean and Gulf of Mexico, his memory lingers on. From Barbados to Corpus Christi, from the 3d through the 11th, his wake was strewn with grounded ships, capsized oil rigs, and wrecked ports. Allen played no favorites--a wooden schooner, luxury yachts, several oil rigs--they all fell victim to the fury of the storm.

By early Sunday morning August 3 Barbados and Trinidad had already issued gale warnings and a hurricane watch for the southern Leeward and northern Windward islands. That night they felt the brunt of the rapidly building hurricane. St. Lucia, particularly the south coast, was the hardest hit. Preliminary figures indicate 18 deaths and hundreds of people left homeless. Crop damage, particularly the banana crop, was severe. The port and capital of St. Lucia, Castries, was battered. The wood schooner BUCCANEER, which was moored to the main jetty, broke its lines and was driven aground. The SEA HORSE, a catamaran, came ashore 30 ft astern of the BUCCANEER. The Venezuelan naval training vessel AMAZONAS was also driven aground on the south side of the harbor. Numerous other yachts and vessels suffered minor contact damage. The SEA HORSE eventually was lifted out by a crane barge, while the AMAZONAS was quickly re-

floated. The JORGE H. dragged her anchors and suffered damage to her port rudder. Massive power outages led to a closing of the port to evening traffic for a time.

Near Barbados the CURRENT TRADER and the BEN VEG were driven aground just outside Bridgetown Harbor. Both were eventually refloated. In the harbor some 20 small fishing boats were destroyed and another 75 damaged. At St. Kitts waves up to 25 ft washed several barges ashore, badly damaged a warehouse, and flooded some houses. Southeast of Basseterre, a new deepwater port still under construction suffered extensive damage. Elsewhere, one death was reported on Guadeloupe.

Passing south of the Dominican Republic and close to Haiti, Allen spread strong winds and torrential rains along the island's south coast. Hardest hit was Haiti's southwest coast on the 6th. An estimated 220 people were killed, and some 835,000 were left homeless. Flash floods were the major reason. They also destroyed about one half the nation's coffee crop; total damage was estimated at more than $400 million.

Earlier, on the 5th, the GEORGIOS, sailing about 200 mi southeast of Kingston, Jamaica, radioed a course change to avoid Allen. The 7,223-ton cargo vessel was bound for Belize from Santo Domingo. After the vessel was considered missing, a Coast Guard search turned up an empty lifeboat with the ship's former name. There were 27 people on board.

Allen brought his 145-kn winds and torrential rains to eastern Jamaica early on the 7th. The banana crop was particularly hard hit. Trees and powerlines littered roads. Torrential rains triggered extensive flooding. The Outrum River in Port Maria overflowed its banks, and floodwaters in the town were 5 to 6 ft deep. Damage was estimated in the millions of dollars. Much of Cuba was spared, but at Nuevitas the GOOD TRANSPORTER, a Greek cargo vessel, was driven aground. On Grand Cayman the 560-ton MIK TRADER and an American yacht DREAMERS DREAM both broke anchorage and grounded. The yacht then broke up and washed ashore. Alongside the marina at Cayman Cai Developments, the ferry NOA capsized and sank.

As Allen approached the U.S. coast oil rigs were evacuated and ships sought shelter. During these evacuations an oil company helicopter crashed, killing 13 people off the Louisiana coast. On the 8th a drilling rig in Moss Lake, La., overturned and spilled her crew of 15 into the water; 2 men died. On the 7th the Dixilyn-Field 81, a drilling rig in the North Padre Island area, was shut down and evacuated. The rig later capsized and sank in 102 ft of water.

The MARY ELLEN, carrying 280,000 barrels of oil and a crew of 37, sought refuge at Corpus Christi on the 8th, but all berths were full. She anchored off Port Aransas. When conditions worsened, the ship attempted to proceed, but her engines failed. Then her two anchors would not hold. Soon the vessel was drifting without power in 30- to 40-ft seas. The master was advised to flood all tanks and put the ship hard aground, which he did. On the 16th after off-loading some 150,000 barrels of crude, the vessel was refloated. Elsewhere along the northeast Texas coast, the ATHENIAN, ARGONAUT, and CHEMLINK 404 all ran aground in silted ship channels.

Small boat damage was extensive in the Corpus Christi area. In the inner harbor about 50 shrimp boats were moored to ride out Allen. It was estimated that nine of the vessels sank. The storm may also affect the shrimp season in another way. Tides up to 10 ft were responsible for cutting up to 16 new channels through Padre Island. This may affect the salinity of the Laguna Madre--a shallow shrimp-breeding ground between the island and the Texas mainland.

Casualties--The 15,414-ton Greek GEORGIS PROIS and 4,576-ton Greek KAPETAN ANTONIS collided in fog between Cape Race and St. Pierre on the 1st. On the 7th, the 15,494-ton Spanish SERANTES and the 5,888-ton Pakistani TAXILA collided in fog 18 mi west of Gibralter . The pipe-laying barge No. 27 suspended operations in the North Sea because of bad weather on the 10th; the stinger was reported sunk. The Panamanian PANAGIA SPILIANI was at Tunis on August 1 with heavy-weather damage that occurred during July 22 to 30. The 39,260-ton Liberian CARBAY discovered apparent heavy-weather damage from a voyage from Hampton Roads to Rotterdam while in drydock. The British KING RICHARD reported heavy-weather damage at Lisbon on the 25th. The ANANCY and MARAZUL collided in strong winds at the port of San Andres. On the 31st two Canadian fishing vessels collided in fog southeast of Halifax. The 1,100-ton CAPE BEAVER rescued 14 crewmen from the 226-ton MARGARET JANE, which sank with four crewmen missing.

Other Casualties--The Saudi Arabian AMAL drifted in strong winds while anchored at Jeddah and grounded. The 8,915-ton Greek JADE reported severe storm conditions near 38.3°N, 39°W, and shifting of cargo on the 3d. The 10,732-ton Liberian ATHLOS apparently sank on the 30th, 1,000 mi northwest of Cape Town in storm seas. She took on water after springing a leak in her hold. The 28 crewmen were rescued by the PORSANGER. The 11,219-ton American SANTA MAGDALENA sustained heavy-weather damage on the 27th during passage from Buenos Aires to Valparaiso.

SMOOTH LOG, AUGUST 1980--There were major differences between the climatic storm tracks and the actual tracks this month. The primary track was from the Great Lakes, across the Maritime provinces, and then eastward toward the United Kingdom. Over the eastern ocean the track was more diffuse, spreading from the English Channel to Iceland. There were many storms over northeastern Canada, but they were west of their usual location. Only one penetrated the Labrador Sea as it raced southeastward. The usual track crosses northern Quebec into Baffin Bay. There was a secondary track northward out of the United Kingdom.

With the differences in the storm tracks it is only logical to expect the sea-level pressure pattern to differ from climatology. There were two 1008-mb low centers, one about 500 mi southeast of Kap Farvel and the other 600 mi east-southeast of Kap Farvel. The normal shows two 1008-mb centers, one over Cape Chidley and the other 1008-mb center slightly south of Iceland. There were multiple high centers, averaging 1015 mb, surrounding Greenland. The Azores High at 1023 mb was normal but southwest of its usual location. Pressure over the eastern United States was near normal, but it was higher than normal over western Europe. Low pressure centered near the North

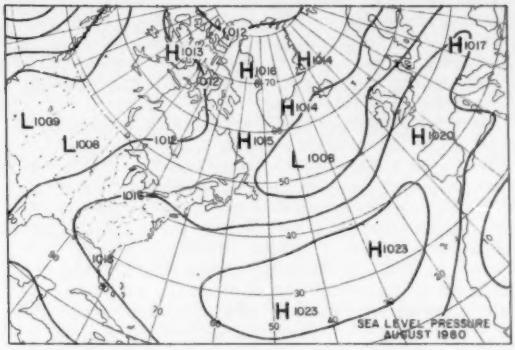


Figure 25.--Mean sea-level pressure.

Pole was lower than usual at 1001 mb (fig. 25).

The primary anomaly center was minus 6 mb near 47°N, 37°W. The low pressure over the North Pole produced a minus 11-mb circular anomaly. The Labrador Sea and Baffin Bay were covered by a positive 6-mb anomaly, while western Europe supported a positive 3-mb center.

The upper air pattern was quite different from climatology. The LOW over the North Pole was 138 m lower than normal. The long-wave trough from this LOW was shifted from 65°W longitude to 30°W longitude. South of latitude 60°N the trough line extended southwestward paralleling the East Coast about 300 mi off the coast rather than over it.

There were two tropical cyclones this month--hurricanes Bonnie and Charley. Although hurricane Allen formed the last day of July, all its violence and destruction occurred this month.

Extratropical Cyclones--The principal cyclones this month were tropical. There was an average number of extratropical cyclones, some fairly large in size, but not especially strong.

While hurricane Allen was swirling through the Caribbean, this storm formed over northern Maine on the 4th. At 0000 on the 6th it was over Cape Race. There were thunderstorms in the warm sector that day. The WVFM found 35-kn gales from the northwest on the 7th as did a Soviet ship at 47°N, 36°W, near the occlusion. By 1800 the storm had moved east of the GENERAL JASINSKI (44°N, 45°W) bringing northwesterly winds of 48 kn. At 0000 on the 9th OWS Lima measured 35-kn southeasterly winds with 13-ft waves. By 0600 another LOW between Greenland and Iceland absorbed this center.

This LOW was first analyzed over the southeastern shore of Lake Superior on the 8th. It raced eastward and was over the Gulf of St. Lawrence on the 10th. The FALCON was near 40°N, 58°W, with 37-kn winds and 15-ft seas. At 1200 on the 11th the LOW was 988 mb centered near 51°N, 45°W. The ITALICA (38°N, 48°W) was slightly south of the cold front with 48-kn winds. The SEA-LAND GALLOWAY at 44°N, 48°W, was some distance north of the front with 20-ft seas. At 1800 on the 12th, the TFL EXPRESS was about 180 mi south of the center and had just passed through a trough line, when she measured 60-kn winds with only 10-ft seas. On the 13th at 0000 the QUEEN ELIZABETH 2 was in the southeast quadrant sailing into the storm with 35-kn winds. West of the center OWS Charlie measured 35-kn winds from due north with 15-ft seas.

On the 14th the LOW suddenly turned northward, and a second LOW broke off and remained stationary for a few hours. The SEATRAIN CHARLESTON was sailing westward with 50-kn winds from the north and 13-ft waves pounding her beam. The storm moved over Iceland and was lost over the Greenland Sea.

Lake Erie generated this storm. By 1200 on the 12th the 1004-mb LOW was over Nova Scotia. The British ship GBPW near 39°N, 63°W, found the winds to be 51 kn from the southeast. A Swedish ship was north of the warm front at 1800 on the 13th with 40-kn winds from the east. On the 15th the LOW moved under strong zonal upper air flow and raced eastward. At 1200 the LOW was analyzed as 988 mb, and the DART EUROPE (48°N, 30°W) was only yards from the center with a pressure of 989.6 mb and 50-kn winds from the west. At midday on the 16th the STAR BULFORD near 51°N, 19°W, was about 200 mi south of the 992-mb LOW with 40-kn winds and 16-ft waves. On the 17th the FEDERAL RHINE (52°N, 15°W) and the NAET (60°N, 00°W) both had 40-kn gales. The storm was traveling northward over the Norwegian Sea on the 18th.

South-central Canada was the birthplace of this storm. It moved north of the Great Lakes on the 14th. The storm was over Cape Breton Island at 997 mb at 1200 on the 16th. Several ships near the Maritime provinces had gales.

On the 17th there were many reports from ships with gales southeast of Newfoundland. The ORCO MINER (46°N, 42°W) north of the associated warm front had 45-kn southeasterly winds with 23-ft seas. At 0000 on the 18th the storm was tightly wound around a 976-mb center near 52°N, 48°W. Charlie measured 41-kn winds out of the southeast and 15-ft seas. At 1200 the BARETTE JACOB (50°N, 45°W) radioed a report of 48-kn southwesterly winds with 23-ft seas. The SEA-LAND MARKET was not far away at 1800 with 40-kn winds. The NORTHWIND was southeast of Kap Farvel at 1500, where she measured winds of 46 kn. On the 19th Charlie had 20-ft seas, but before nightfall the LOW had died and another had formed near Iceland. Hurricane Bonnie was approaching from the south.

As the storm above turned northward on the 18th, a small LOW formed in the trough. The SEA-LAND GALLOWAY was northwest of the 1002-mb center with 35-kn northerly winds and 20-ft waves. She was following the storm, and 24 hr later had 40-kn winds from the northeast with 26-ft seas and 38-ft swells. At this time hurricane Bonnie was northeast of the LOW near 46°N, 40°W. The high swell waves were probably attributable to Bonnie. This storm was turning northward on the 19th.

There were two reports of 50-kn winds at 1200 on the 20th--the ATLANTIC COGNAC (44°N, 46°W) and the THAMESFIELD (41°N, 52°W). The AMERICAN ARGOSY was at 45°N, 50°W, with 45-kn winds and 20-ft waves.

As the storm traveled northward it also curved westward and weakened. On the 21st the LOW stal-

led near 52°N, 48°W, and hovered around that position until the 24th, when it was absorbed by approaching tropical storm Charley.

This storm blossomed in 12 hr between Kap Farvel and Iceland on the 19th. At 1200 the MANCHESTER CONCORDE was 400 mi south of Keflavik with 43-kn winds and 18-ft waves. On the 20th the storm was felt on the North Sea. Many ships and platforms had gales with the RIGG (60°N, 09°W) calling the seas 25 ft. At 0000 on the 21st the LOW crossed the Norwegian coast at 976 mb. The winds picked up as they gathered up a northerly component. There were several reports near 50 kn with the waves as high as 26 ft. This was a large LOW. It was centered over the Gulf of Finland on the 22d. High winds were still blowing over the North Sea. The Danish station Thyboron measured 45-kn winds. The highest waves were 23 ft. On the 23d the LOW was over northern Russia, and the winds returned to a more reasonable speed over the North Sea.

This was not much of a LOW until tropical storm Charley started feeding warm moist air into the circulation. The LOW formed northeast of Charley on the 24th. On the 25th it turned to a northward track. Late in the day the SEA-LAND CONSUMER found gales. At 0000 on the 26th the 980-mb LOW was 180 mi south of OWS Charlie. He had 35-kn winds and 18-ft seas. Tropical storm Charley was about 450 mi to the south. A drilling ship over the Grand Banks had 35-kn winds. The ITALICA was south of Charley with 50-kn winds. By 1200 Charley was extratropical. At 1800 the SKULPTOR VUCHETICH had only 37-kn winds near 43°N, 24°W, but the swells were 26 ft. The ZINNIA (52°N, 42°W) had 47 kn on the 27th. The storm weakened on the 28th.

Tropical Cyclones--Hurricane Bonnie lived and died far out in the North Atlantic. Her northerly track took her from west of the Cape Verde Islands to southeast of Greenland as she flirted with the 40th meridian for more than 2,000 mi. Bonnie developed from a large area of disturbed weather. The first indication of her existence came from the RUDDBANK and from satellite photographs on the 14th. Bonnie intensified as she started her northward journey. By the morning of the 15th, some 1,200 mi southwest of the Azores, she reached hurricane intensity with a well-developed eye. Bonnie peaked on the 16th when winds near her center climbed to 75 kn. She was moving northward at about 12 kn. Later in the day winds dropped to minimal hurricane strength. She maintained this intensity for the next several days, as she passed 450 mi west of the Azores. By the 19th Bonnie was moving over the colder waters of the North Atlantic. She was also rapidly accelerating, reaching forward speeds of up to 45 kn toward the north-northeast.

Hurricane Charley had his roots in a persistent extratropical low-pressure system off the U.S. East Coast. The LOW gradually acquired the structure of a tropical cyclone. By the 23d, some 550 mi east of Norfolk, winds near his center were estimated at 70 kn. After meandering aimlessly for a time, Charley began moving eastward. Maximum winds remained at 70 kn, while gales extended out 150 mi to the north of the center and 50 mi to the south. Gradually Charley's forward speed increased to about 17 kn. By the 24th Air Force reconnaissance and satellite pictures showed a weakening, and Charley was downgraded to tropical-storm strength. Early on the 25th Charley raced across the 50th meridian at about 40 kn. Later in the day he was absorbed into a large low-pressure system.

Casualties--The Cypriot ARTEMIS encountered heavy weather in the eastern Mediterranean on the 4th and water leaked into the engineroom. Crew abandoned ship to the PRIMAVERA I, which towed the ARTEMIS to Port Said. The 344-ton Liberian LOFA struck a submerged object in heavy weather and poor visibility off Monrovia. The vessel was beached at Buchanan. The 86,098-ton British NORDIC CRUSADER sustained heavy-weather damage on the 6th. The West German WESTERDIEK grounded in fog on the 8th off Loviisa.

The 25,691-ton THEOMITOR sank at 47.5°N, 38.7°W, after taking in water through a cracked hull in heavy weather. The Polish KOPLANIA MYSLOWICE and the 10,250-ton Brazilian CALANDRINI collided in fog off Amsterdam on the 17th. What was described as a rouge wave swept a 13-yr-old boy who drowned off the excursion boat OREGON INLET QUEEN at Oregon Inlet on the 21st. A series of waves knocked down other passengers on the foredeck. The LAKE ALMANOR suffered damage from heavy swell at Hampton Roads on the 24th during bunkering. The yacht JOLLY ROGER was dismasted on the 30th off Margate, England. The 836-ton Panamanian ferry IVA suffered heavy-weather damage this month. The American GULF BANKER had rough-sea damage to deck cargo.

Other Casualties--The U.S. Navy cruiser ST. LOUIS renamed the Brazilian ALMIRANTE sank off the Cape of Good Hope while being towed to breakers in Taiwan.

Smooth Log, North Pacific Weather

July and August 1980

SMOOTH LOG, JULY 1980--There appeared to be about the average number of extratropical cyclones crossing the North Pacific this month. None were very severe. The primary storm path followed a mean path between the two paths indicated by climatology. The storms originated near Honshu and tracked slightly north of eastward to about 160°E, where they turned northeastward toward Bristol Bay. Several storms took circuitous paths across the Bering Sea.

The 1030-mb Pacific High normally centered near 40°N, 150°W, was the dominant pressure feature. This was 5 mb higher than normal. No closed Aleutian LOW is indicated on the monthly normal sea-level pressure chart, but there was an anomalous 1007-mb Low north of Kamchatka this month. There was also an anomalous 1019-mb High over the Arctic Ocean north of Point

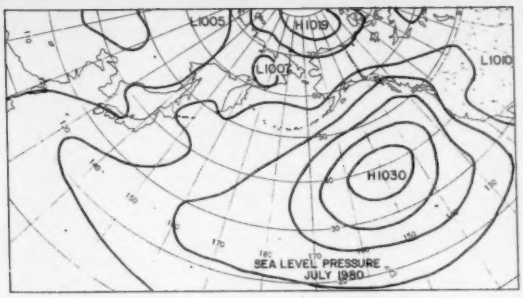


Figure 26.--Mean sea-level pressure.

Barrow. The few storms that continued over Alaska and into Canada moved through the weak area between the two Highs (fig. 26).

The two significant anomaly centers were both positive; a 5 mb centered with the Pacific High and an 8 mb with the High over the Arctic Ocean. A weak negative anomaly area stretched from Hudson Bay westward into eastern Siberia.

The surface Low over Siberia was reflected at 700 mb as a closed circulation. The trough along the Asian coast was sharpened. Also, the ridge over Alaska and the western Canadian coast was intensified.

There were 10 tropical cyclones this month, 5 over the western ocean and 5 over the eastern ocean. They were tropical depression 10, tropical storm Ida, and typhoons Joe, Kim, and Lex in the west; and tropical storms Darby, Estelle, and Frank, and hurricanes Georgette and Howard in the east.

Extratropical Cyclones--The month started with the Pacific High firmly entrenched north of Hawaii and west of northern California. No storm or frontal system made any significant inroads until the 20th. At that time the Pacific High split into two to three weak cells, and the cyclones and fronts were able to penetrate farther south. By the 27th the Pacific High was consolidating over midocean, and during the first week in August was settled again in its usual location.

This LOW in the trough of a storm over the Bering Sea existed on the 1st. It traveled northeastward and by the 3d announced its existence. The HONSHU GLORIA (50°N, 178°W) found 26-ft swells. The JAMAICA MARU (46°N, 175°W), 225 mi east of the center, had 48-kn winds from the southeast. She still had 40-kn winds on the 4th. At 1800 the American KHRH had 39-kn winds near 48°N, 163°W. The storm passed slightly west of Saint Paul Island on the 5th. The HONSHU GLORIA reported 41-ft swell waves at 0600 near 52°N, 160°W. The MARINER was south of Kodiak Island with 40-kn southerly winds. On the 6th, 7th, and 8th the storm made a cyclonic loop south of Saint Lawrence Island and dissipated over Alaska on the 9th.

Monster of the Month--This storm came out of the Yellow Sea on the 1st. It traveled along the northern shore of Honshu and was over the open water on the 3d. Soviet fishing vessels in Tatar Strait were receiving gales, as were ships along the front south of Japan. The storm had multiple centers and was of no concern until it consolidated into one center on the 6th. The DAIRIN MARU was north of the center with 36-kn winds out of the northeast. At 0000 on the 7th the 992-mb storm was at 43°N, 173°E. The OCEAN LEAP (39°N, 177°W) was in the frontal zone with 41-kn winds from the south-southeast. On the 8th the DAIRIN MARU (48°N, 177°E), which was following the storm, had 40-kn winds and 12-ft seas. At this time the storm turned a cyclonic loop, completing it on the 9th and heading northward. This was odd for the storm's location; usually storms do this much farther north. The PRESIDENT CLEVELAND was sailing southward in the southeast quadrant and had 35-kn gales and 12-ft seas. Her winds were 40 kn on the 9th.

The NANCY LYKES (40°N, 169°W) was near the front on the 10th and her report read 60 kn with 23-ft waves. The storm was moving northeastward against the 1034-mb Pacific High. On the 11th a SHIP (48°N, 175°W) southwest of the storm reported 25-ft seas. Still farther south the SINCERE No. 5 reported 20-ft swells. The PRESIDENT PIERCE had gales at a pressure of 995.6 in the 994-mb storm as the storm switched to a more southerly center. At 0000 on the 12th the new center was near 53°N, 167°W. The strongest winds were in the southeast quadrant. The JAPAN RAINBOW had 48 kn, the SHIMA MARU had 45 kn, and a SHIP at 49°N, 166°W, had 25-ft seas. By the 13th the storm was very weak.

A long frontal system extended southward from Alaska to 35°N and then westward to Japan and on to tropical storm Ida near Taiwan. At 1200 a frontal wave was analyzed over Honshu. Gales were blowing on the 12th. The storm was 988 mb near 40°N, 160°E, on the 13th. The KAMNIK (37°N, 151°E) had 44-kn northerly winds. The PRESIDENT ADAMS (47°N, 166°E) had easterly 40-kn winds, while the TOYOTA MARU, south of the center, was sailing into 20-ft seas. The KOREAN COMMANDER was about 150 mi northwest of the center of the storm (barometric pressure 993.5 mb versus 998 mb) with 33-ft waves on the 14th. Two Japanese ships near 41°N, 168°E, had 40-kn gales and 20-ft waves on the 15th. There were a few minimal gales until the 17th, when the winds decreased to only breezes.

The remainder of the month was quiet with no well-organized extratropical storms. There were a few isolated gale reports here and there. Throughout the month there were gale reports off the U.S. West Coast as the Pacific High pushed eastward and the heat Low over the interior desert intensified.

Tropical Cyclones, Eastern Pacific--Darby was the

first of a number of short-lived tropical cyclones that roamed these waters in July. She formed on the 1st near 13°N, 110°W, and dissipated on the 3d. Darby moved westward. Her winds peaked at 45 kn on the 2d.

From the 12th through the 28th tropical storms Estelle and Frank, along with hurricane Georgette, all developed south-southeast of Socorro Island. Estelle was already a tropical storm when discovered on the 12th. Her winds reached 40 kn, but after moving west-northwestward, she quickly dissipated the following day. Frank flared briefly on the 18th. He moved in a more westerly direction, peaked at 45 kn on the 20th, then died on the 22d. Six days later Georgette put in an appearance. On a northwesterly heading, she reached hurricane strength by the 29th, when winds briefly climbed to 65 kn. The ALVA MAERSK, MOBIL ARCTIC, and TOYOTA No. 22 were on the outskirts of the storm with gales and waves up to 21 ft. The following day Georgette was downgraded to a tropical storm and by the 31st was finished. All these storms suffered from cool surface water and a lack of upper level support.

Just before the month closed hurricane Howard developed about 300 mi east of Clipperton Island. By the August 2 he had reached hurricane strength near 13°N, 111°W. He headed northwestward. Maximum winds rose to 80 kn and then peaked at 90 kn on the 3d. However, as Howard approached 20°N, cooler waters dampened his enthusiasm. Late on the 5th he dropped to tropical-storm intensity. By the 7th, as he crossed 25°N near 121°W, Howard was a minimal tropical storm and sinking fast.

Tropical Cyclones, Western Pacific--Tropical storm Ida developed on the 6th just east of the southern Mariana Islands. The following day the CHIKUMASAN MARU, sailing northward, encountered 35-kn winds about 120 mi north-northwest of Ida's center. Ida was moving west-northwestward. By the 8th winds near her center climbed to 55 kn. Early the following day they briefly reached 60 kn as Ida entered the Formosa Strait. The 5,486-ton Philippine REYNA FILIPINA dragged anchors in rough seas and strong winds on the 9th in Manila Bay. A reconnaissance aircraft reported a 979-mb pressure. Ida very nearly became a typhoon. She passed close to Basco Island early on the 10th, where a minimum pressure of 982 mb was reported. The BENVALLA, about 40 mi from Ida's center, reported winds of 57 kn with gusts to 75 kn. Early on the 11th, Ida began to turn northwesterly toward the south China coast. She passed 150 mi to the east-northeast of Hong Kong, where wind gusts ranged from 30 to 50 kn. Ida crossed the coast near Shantou, which recorded a 985-mb pressure with 38-kn winds and gusts to 52 kn.

On the 15th a tropical depression formed some 520 mi east of Manila. Initially, it moved rapidly west-northwestward but turned westward and slowed on the 16th. It moved across Luzon close to Manila that evening. On the 17th the ill-defined center, now in the South China Sea, swung towards the northwest and accelerated. That night it slowed and intensified to minimal tropical-storm strength. The following day the VISHVA APURVA encountered 36-kn winds about 110 mi from the center, while the PARONGA reported 37-kn winds some 60 mi from the center. Central pressure was estimated at 996 mb. The system continued northwestward and made landfall near St. Johns Island on the 19th. Later it degenerated into an area of low pressure near Nanning in southwest China.

Typhoon Joe developed from a low-pressure area about 160 mi west-southwest of Guam on the 17th. Moving west-northwestward at 14 kn he reached tropical-storm intensity the following day. By the afternoon of the 19th an eye had formed and Joe was a typhoon. Reconnaissance aircraft reported 65-kn surface winds around a 974-mb center. The following evening Joe was generating 100-kn winds around a 940-mb center with a circulation of more than 400 mi in diameter. Early on the 21st he crossed Luzon causing damage to plantations and crops. According to press reports, about 50,000 Philippinos lost their homes and two fishermen died. Joe weakened over Luzon, but he reintensified over the South China Sea. The LNG CAPRICORN found 51-kn winds and 13-ft waves while passing through the Luzon Strait. The JUPITER III dragged anchors and crashed into a sea wall at Manila. Early on the 22d maximum winds were estimated at 80 kn. The SAMOA encountered 58-kn winds 150 mi from the center, and the APOLLO PEAK about 40 mi from the center reported 57-kn winds and a 973-mb pressure. Joe crossed the Luichow Peninsula on the 22d. According to Chinese newspaper accounts, the typhoon caused 188 deaths and was the strongest in 26 yr. The island station at Bach Longvi recorded 62-kn winds and a sea-level pressure of 980 mb early on the 23d. Joe then turned westward and crossed the Vietnam coast near Hanoi. He weakened rapidly once over land.

Typhoon Kim developed as a tropical depression some 330 mi southeast of Guam on the 20th. Moving steadily toward the west-northwest at 17 kn she intensified into a tropical storm by the 22d. Kim reached typhoon strength the following day some 420 mi east-southeast of Manila. Satellite photos, on the 24th, indicated a distinct eye and a circulation that had broadened to 600 mi in diameter. Later in the day a reconnaissance aircraft reported maximum surface winds of 110 kn around a 916-mb pressure center. Kim hit the coast of Luzon early the next morning. Her devastation included 31 deaths and 8 people missing. Some 12,000 homes were destroyed as 500 villages were flooded. After crossing Luzon Kim weakened and entered the South China Sea on the evening of the 25th. The next morning the JAPAN IRIS encountered 58-kn winds about 80 mi from the center. Later Pratas Island recorded winds of 32 kn when Kim was 80 mi to the southeast. Kim was downgraded to a tropical storm. About 120 mi southeast of Hong Kong, on the 27th, Kim turned northward. She crossed the south China coast some 55 mi southwest of Shantou, where maximum gusts of 70 kn were reported. Gusts in the Hong Kong area ranged from 42 to 69 kn.

Typhoon Lex developed about 300 mi west of Marcus Island on the 29th. While he was hesitant about a course, he organized rapidly and reached typhoon intensity by the 31st. At this time Lex was heading west-southwestward. By the 2d, packing winds of 75 kn, he turned northward. Winds climbed to 80 kn late in the day and into the 3d. The DAMPIER MARU, which was sailing northward and catching up to the storm, was running in 20-ft swells from the 1st through the 3d. On the 1st she reported 40-kn winds 180 mi southeast of Lex's center. The storm began to weaken and slowly

turn extratropical as Lex swung toward the northeast on the 5th. He was still a potent storm, however, as testified to by the ATLANTIC PIONEER, which ran into 20-ft swells in 54-kn winds some 360 mi east of the storm's center. By the 7th Lex had completed his extratropical transformation as he crossed the 35th parallel near 155°E.

Casualties--The 83,601-ton American LNG LEO parted a mooring rope on the 2d in high winds at Kobe damaging the pier and ship. The 38-ton fishing vessel SEA FINN and the 30,340-ton MILROSS collided in rough seas off Oahu on the 7th. The SEA FINN sank. The husband and wife owners were injured but rescued. The 697-ton DAISEN MARU and the 3,000-ton BONNY OCEAN collided in dense fog on the Inland Sea on the 7th. Two small Japanese vessels, the 159-ton KINPUKU MARU and the 499-ton KOYO MARU collided in fog on the 8th. The former sank and both crewmen were rescued.

The American frigate MEYERKORD and the 2,515-ton SENSHO MARU collided in dense fog off Matsuyama. There were no injuries. The Panamanian BLUE RIVER (4,259 tons) sank 300 mi southeast of Manila on the 12th. She was struck by large waves off Catandunanes Island. The Greek PROSO requested a weather-damage survey at Kobe on the 24th.

Other Casualties--The 4,443-ton CORAL ISIS encountered heavy weather off Australia on the 4th, 5th, and 6th with exceptionally high seas on the 5th. The Greek TYR had heavy-weather damage between Dubai and Durban June 23 to July 4. The ARAB ALHIJAZ for Bombay reported heavy-weather damage on arrival. The 16,293-ton ANTARTICO alleged shell damage between the 11th and 14th at Lirquen, Chile, due to heavy-weather grounding. The British ALNWICK CASTLE claimed heavy-weather damage on arrival at Port Kembla on the 17th. The bulkcarrier OCEAN CORACLE encountered heavy weather during the 17th to 26th from Dammam to Port Elizabeth.

SMOOTH LOG, AUGUST 1980--There were fewer extratropical cyclones this month than normal. They followed climatology only in the largest sense. Those that survived to clash with the larger-than-life Pacific High were forced into a northeasterly course. The primary track--if there was one--originated in the vicinity of 40°N, 170°E, and traced northeastward in the Gulf of Alaska. Another track could be said to originate east of Mys. Lopatka and end over Bristol Bay.

The mean sea-level pressure pattern reflects the average storm tracks. Without a doubt, the major feature was the 1032-mb Pacific High, 8 mb higher than normal, near its normal 40°N, 150°W, position. There was also a 1018-mb abnormal HIGH over the Sea of Okhotsk. The 1012-mb Aleutian Low was 4 mb higher than its climatological counterpart and over the Seward Peninsula, rather than south of Mys. Navarin (fig. 27).

The ocean north of 40°N and west of longitude 170°W, and north of 27°N and east of 170°W, had above-normal sea-level pressures. The negative area to the south had a maximum of minus 3 mb. There was a deep LOW over the North Pole, which produced a minus 11-mb anomaly over the Arctic Ocean.

In the upper air the subequatorial High was higher than normal. A trough extended southward from the Polar Low over the Bering Strait. The strong HIGH accented the ridge west of the North American coast and the trough over the coastal mountains. One of the more salient features was a deep trough east of the Asian coast. There is normally a weak trough in this area, but higher-than-normal heights inland of the coast greatly accented the west side of the trough.

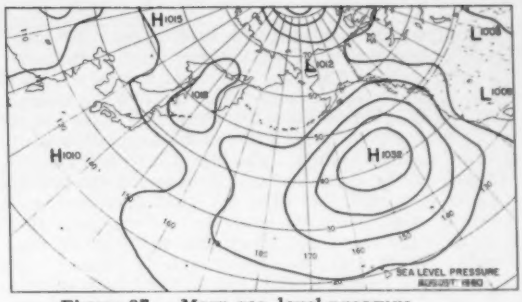


Figure 27.--Mean sea-level pressure.

This was a light month for tropical cyclones, with only four in the North Pacific. Over the eastern ocean there were hurricanes Isis and Javier and over the western ocean typhoons Marge and Norris.

Extratropical Cyclones--The first storm was the extratropical continuation of typhoon Lex. By 1200 on the 7th he had converted to extratropical near 38°N latitude. At that time a Japanese ship was sailing westward across the top of the LOW with gales out of the east and 20-ft waves. At 2100 the HOHKOKUSAN MARU was west of the center with 48-kn northerly winds, 23-ft waves, and a barometric pressure of 987 mb. At 0000 on the 8th the OCEAN VENUS (42°N, 156°E) had 43-kn winds with 12-ft seas. The LOW turned northward on the 8th, and at 1200 the HOHKOKUSAN MARU was in the southwest quadrant with 20-ft waves. On the 9th the LOW was 992 mb near 47°N, 156°E. The NEW GOLDEN PHOENIX was 10° longitude to the east with 52-kn winds.

On the 10th at 1200 the SAKHALINSKIE GORY was near the cold front with 43-kn winds. At this time the LOW suddenly turned eastward to dissipate near the Pribilof Islands on the 13th.

Monster of the Month--This was the extratropical continuation of typhoon Marge. By 1200 on the 16th Marge had incorporated a frontal system into her circulation and was extratropical. The OCEAN ROSE (43°N, 179°E) was very near the center of the storm on the east side with a barometer reading of 988.5 mb. The winds were

43 kn from the southeast with 16-ft waves. She was sailing eastward and tried to cross north of the fast-moving storm. This was like trying to beat a train at a railroad crossing. By 0000 on the 17th the storm had plunged northeastward to 50°N, 175°W, at 986 mb. The PACIFIC VENTURE was in the warm sector with 45-kn southerly winds. The SEA-LAND DEFENDER (48°N, 173°W) measured 45-kn winds and was pounded by 31-ft swells. At 0600 the CRESSIDA near 49°N, 171°W, reported winds of 35 kn and waves to 20 ft. At the same time the NOAA ship SURVEYOR near 55°N, 165°W, had 39-kn southeasterly winds. Reports were sparse at 1200, but at 1800 the TONE MARU (52°N, 164°W) had 44-kn winds from 240° with 23-ft waves. Another ship nearby had 40 kn. In the Alaska fishing fleet the SEA SOUNDER near Unimak Island reported 65 kn with gusts to 80 kn and 30- to 35-ft swells. The LESLIE FOSS north of Port Moller reported 55 kn with gusts to 100 kn and 25- to 35-ft waves.

At 0000 on the 18th there were 12 ships in the storm that reported winds of 35 kn or greater. The NISSHIN MARU No. 2 had the highest of 50 kn near 56°N, 167°W, and the JUPITER No. 1 (55°N, 159°W) had the highest waves with 33-ft swells. The storm was over land on the 19th and weakening, but the DAVIDSON and the SPRAY CAP in the vicinity of 55°N, 154°W, both had 54-kn winds. The storm disappeared from the charts late on the 20th.

This storm formed extratropical as a frontal wave over the Yellow Sea on the 15th. At 0600 on the 17th the TOYOTA MARU No. 10 was east of Tokyo with 35-kn gales and 16-ft waves north of the center. The MARINER and PRESIDENT CLEVELAND were both near 39°N, 148°E, and estimated 45- and 35-kn winds with 20- and 10-ft waves, respectively. On the 18th, 19th, and 20th the MARINER had 40-kn winds with the waves running up to 16 ft. Also on the 19th the MERCY and the NISSAN MARU near 40°N, 168°E, both found winds of 40 kn. By 0000 on the 20th the storm was 995 mb near 43°N, 177°E. There were isolated gale reports with one of 42 kn at 1800. On the 21st the gale reports picked up. The PRESIDENT TYLER (44°N, 180°) had 42-kn northerly winds, and the PRESIDENT CLEVELAND (50°N, 175°W) had northeasterly 62-kn winds. The storm was pushing against the stubborn 1032-mb Pacific High. Several ships had gales on the 22d. As the storm moved over the top of the HIGH on the 25th, it weakened and almost was lost over the mountains on the 26th, but it survived to continue across Canada.

This potential storm came out of China and was over the Yellow Sea on the 30th. The BPPX (34°N, 123°E) radioed a report of 47-kn winds north of the center. By September 1 the storm was near 38°N, 149°E. The PRESIDENT ADAMS was northeast of the center with 45-kn winds and 20-ft waves. The storm was increasing in size, but not especially in strength. By 0000 on the 3d it was 994 mb near 41°N, 168°E. The SEA-TRAIN INDEPENDENCE (45°N, 172°E) located 36-kn winds.

As an aside, the USNS S. P. LEE was north of Point Hope, Alaska, at 71°N, 170°W, with below-freezing 35-kn winds and 20-ft waves. There was a 984-mb LOW over the Arctic Ocean near 82°N, 180°. At 1800 on the 3d the NORTH STAR III was near the Arctic Circle at 66.8°N, 163°W, with 40-kn winds blowing into Kotzebue Sound driving 16-ft waves.

On the 4th several ships had gales, and the HIRA MARU (46°N, 163°W) had northeasterly 48-kn winds. The storm disappeared on the 6th.

Tropical Cyclones, Western Pacific--Typhoon Marge developed on the 8th about 300 mi northwest of Eniwetok. Moving northward along the 155th meridian for most of her life, Marge attained typhoon strength late on the 9th. By the 11th, as Marge passed about 70 mi east of Marcus Island, winds reached a peak of 110 kn. She continued to generate typhoon-force winds well into the 14th after recurving toward the east-northeast. The following day Marge, at tropical-storm strength, began to turn extratropical as she moved into higher latitudes. Marge passed very close to the SEA-LAND PATRIOT late on the 15th. She measured 44-kn winds and 20-ft seas.

Typhoon Norris popped up in the Philippine Sea on the 24th. He headed west-northwestward and reached tropical-storm strength on the 25th as he crossed the 20th parallel near 132°E. Heading for Taiwan, Norris attained typhoon strength on the 26th, about 300 mi east-southeast of Taipei. Maximum winds climbed to 85 kn before Norris swept across northern Taiwan. Heavy rains triggered floods that were responsible for two deaths and destroyed 60 houses. Four fishing vessels also sank off the east coast. However, the torrential rains eased the island's worst drought in 30 yr. Norris crossed the Formosa Strait, moved inland over mainland China near Fu-chou, and dissipated.

Tropical Cyclones, Eastern Pacific--Hurricane Isis began life on the 6th about 180 mi southwest of Acapulco. Paralleling the Mexican coast, she reached hurricane strength on the 7th. By the 8th Isis was generating winds of 75 kn near her center, which was now some 180 mi west-southwest of Manzanillo. The WESTERN SUN had 65-kn winds and 15-ft waves near 19°N, 112°W. Hurricane Isis retained this title until the 10th, when she was demoted to a tropical storm. The following day near 22°N, 117°W, Isis fell to depression strength.

Hurricane Javier flickered briefly toward the end of the month. Forming about 300 mi west of Isis' birthplace, Javier intensified rapidly on the 23d to reach hurricane strength the following day. He moved west-northwestward. Winds near his center climbed to 100 kn on the 25th shortly before he crossed the 115th meridian near 17°N. This, however, was Javier's peak. He gradually diminished. By the 27th near 20°N, 122°W, he was downgraded to a tropical storm. The following day this brief flame was snuffed out.

Casualties--The 86,098-ton British NORDIC CRUSADER on a voyage from Seven Islands to Kure had heavy-weather damage on the 6th. The 15,674-ton Liberian SNOW WHITE was surveyed at Kaohsiung in drydock for heavy-weather damage on the 8th. The 983-ton HOSEI MARU and another 997-ton Japanese tanker collided off northern Japan in fog on the 21st. About 1,700 gal of heavy oil was spilled.

Other Casualties--The British IRON SOMERSBY was at Port Kembla with heavy-weather damage. The BANGLAR JOY diverted to Mormugao due to shifting cargo in heavy weather late in the month. The American GULF BANKER was at Dar Es Salaam on the 20th with weather damage to deck cargo.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

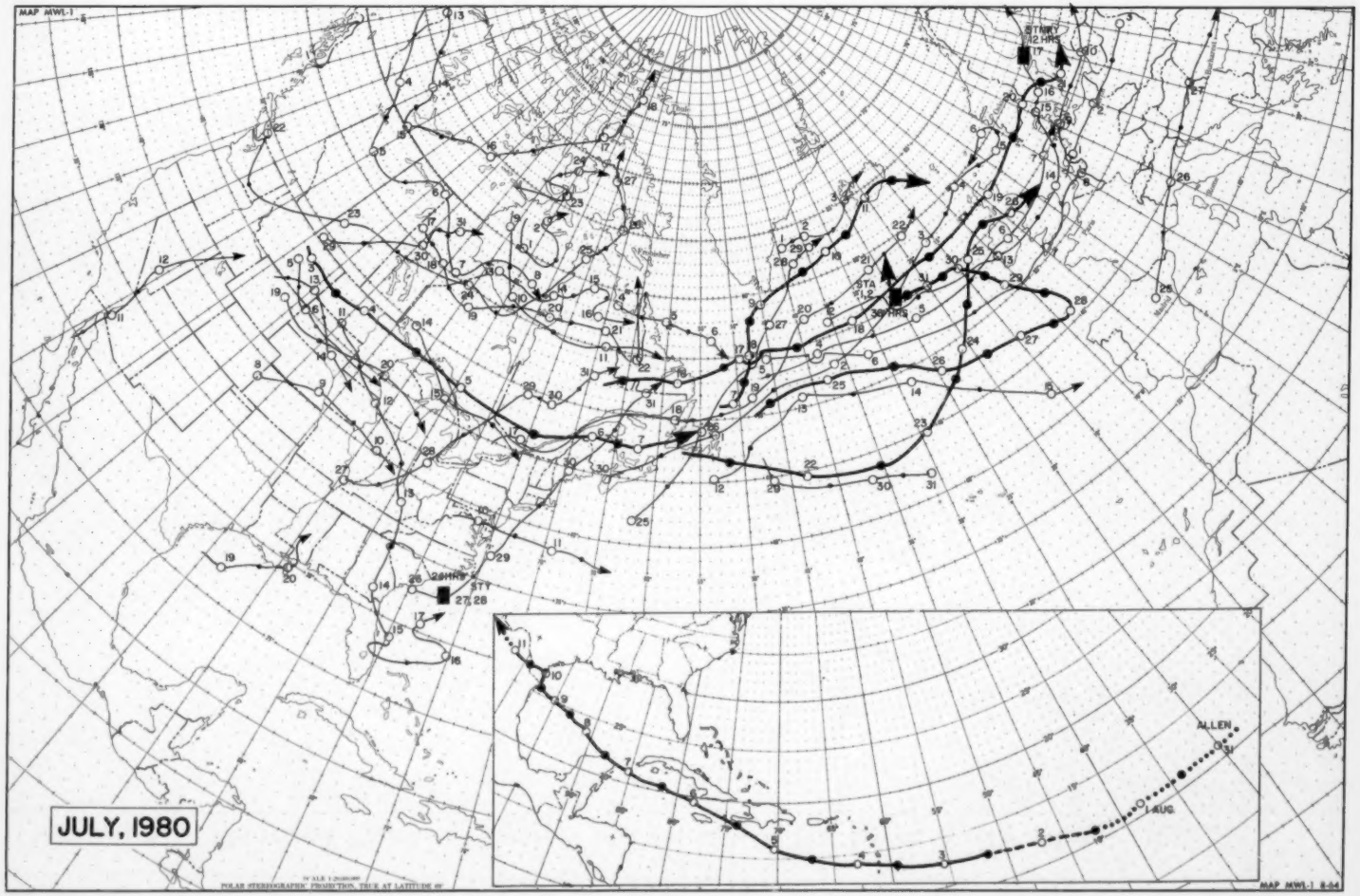


Figure 28. -- Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Atlantic

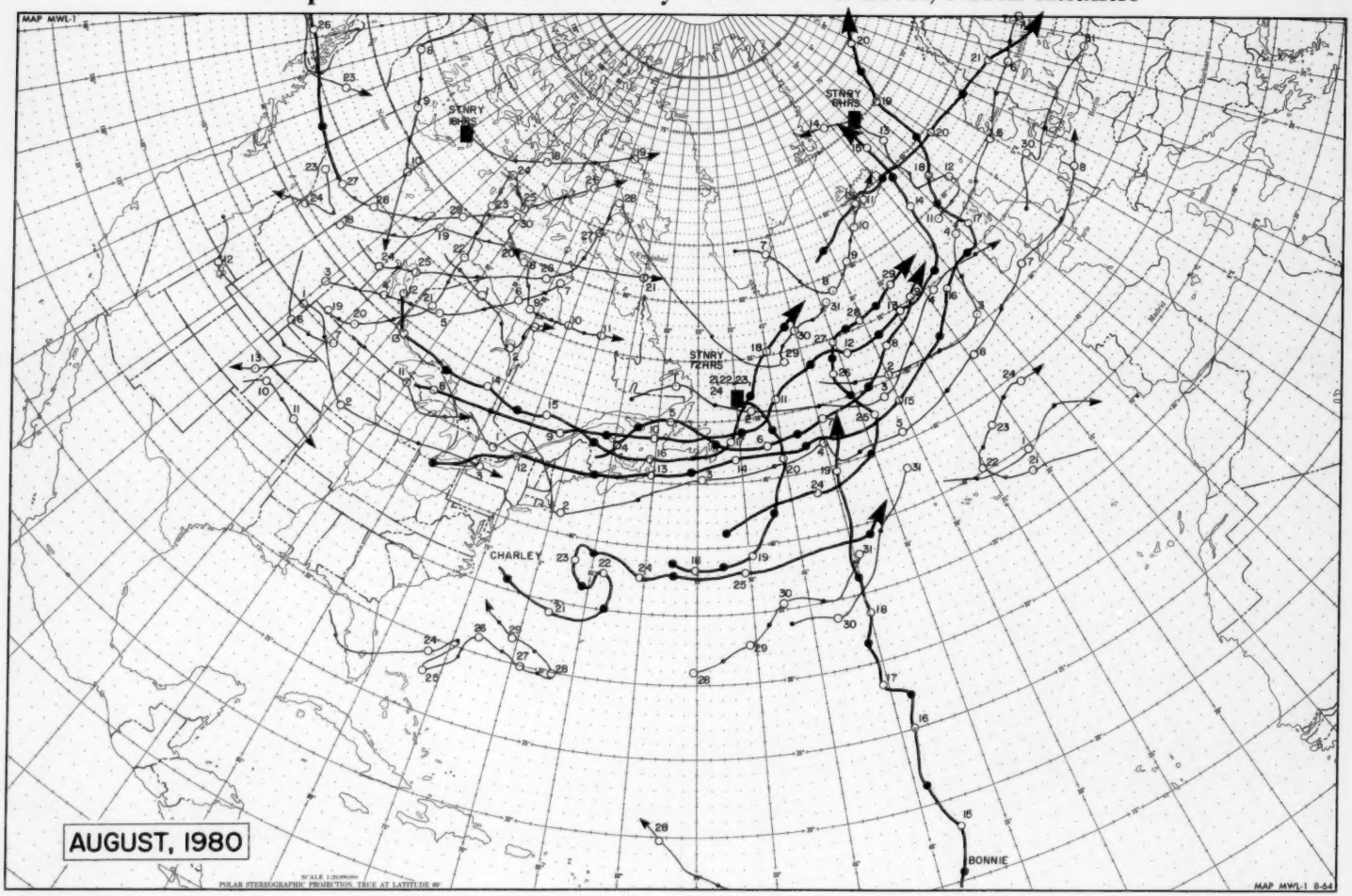


Figure 29. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

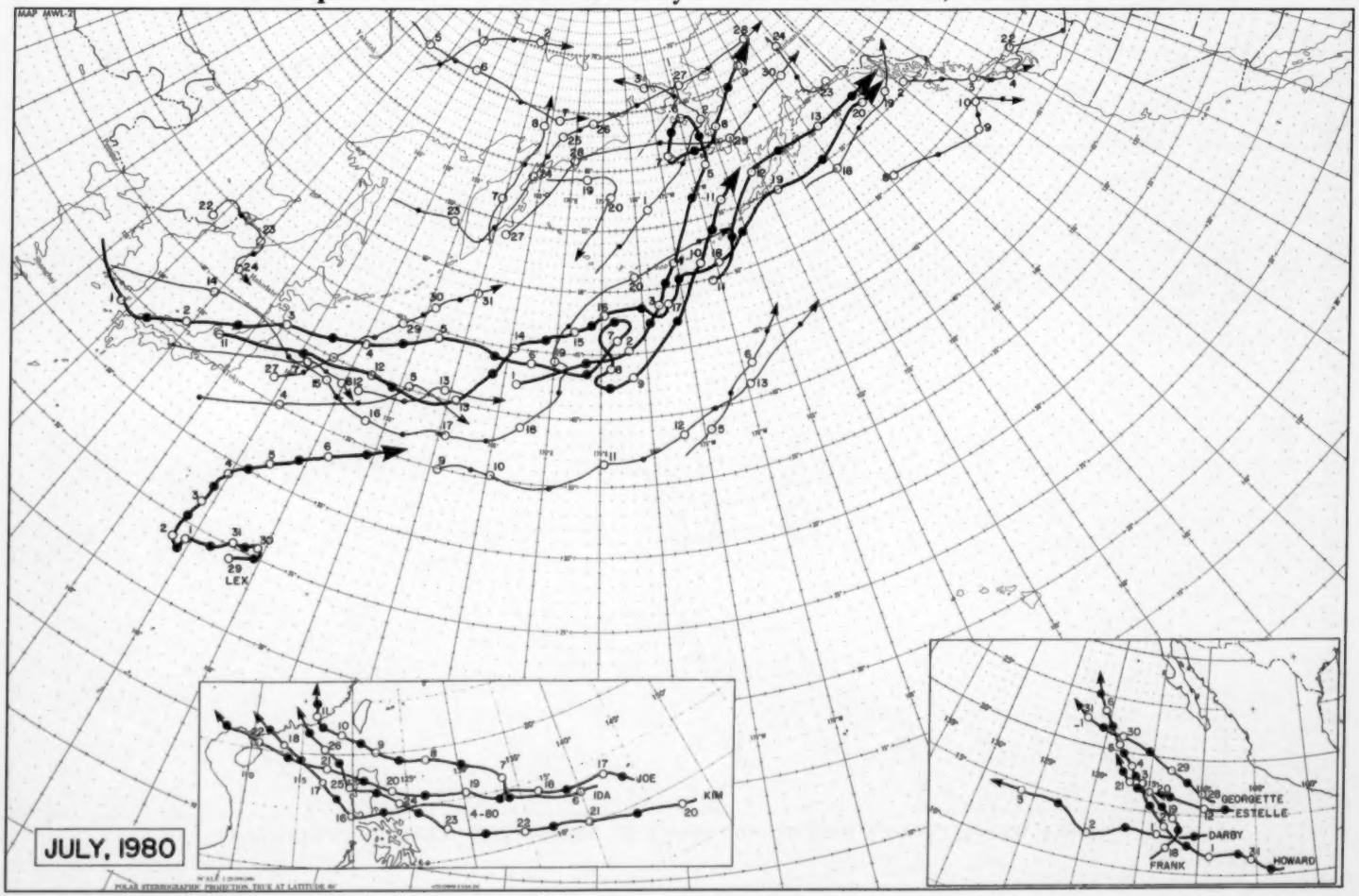


Figure 30. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

Principal Tracks of Centers of Cyclones at Sea Level, North Pacific

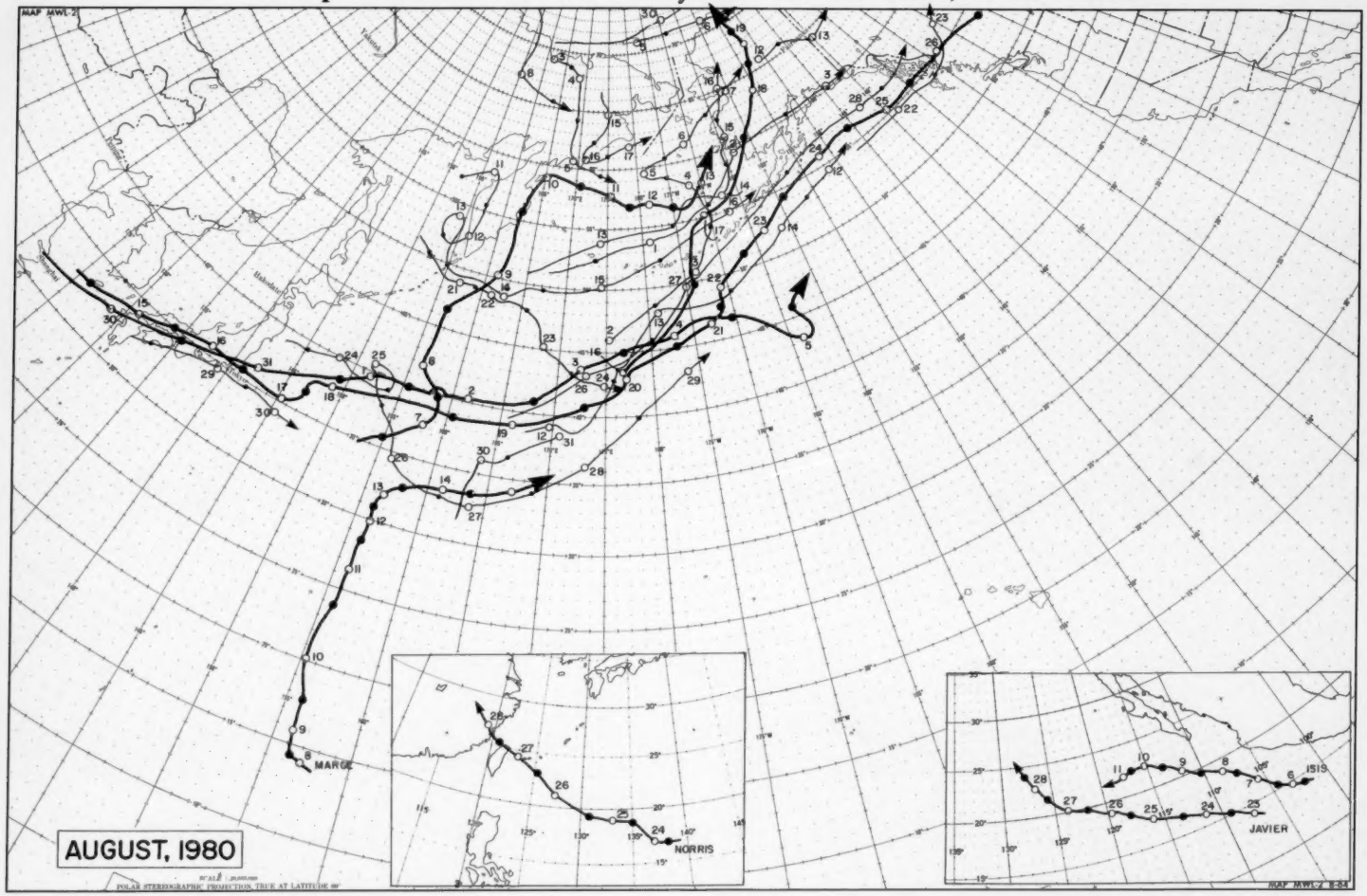


Figure 31. --Open circle indicates 1200 GMT position and closed circle 0000 GMT position. Square indicates stationary center. Cyclone tracks marked with a heavy line are described in the Smooth Log.

U.S. Ocean Buoy Climatological Data

July and August 1980

JULY DATA SUMMARY 41001
AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.7	(04 15)	25.0	27.4	(31 10)	223	31
SEA TEMP (DEG C)	23.1	(01 12)	25.1	27.0	(31 21)	226	31
AIR-SEA TEMP (DEG C)	-02.8	(08 18)	-00.1	01.1	(13 12)	223	31
PRESSURE (MBAR)	1009.4	(11 12)	1017.9	1025.6	(19 19)	223	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.8	7.6					9.4	12.3
NE		1.6	7.6					9.4	11.8
E	.4	2.7	2.7	.9				6.7	13.2
SE	.4	3.6	3.6	.9				8.5	12.6
S	.9	5.4	10.0	2.2				27.4	14.5
SW	.4	4.0	23.3	4.9				37.7	15.1
W	.9	3.1	2.2	.9				7.2	11.3
NW		.9	.4					1.3	8.7
CALM	.4							.4	.0
TOTAL	3.6	28.9	58.3	9.9				100.0	13.8

MAX WIND
SPEED: 27 KNOTS
DIRECTION: 230 DEG
DAY: 10
HOUR: 10

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 221

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	13.6	46.5	19.5	.9					1.3M	3.0M	(06 09)

AUGUST DATA SUMMARY 41001
AVERAGE LATITUDE 34.7N AVERAGE LONGITUDE 072.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	22.9	(24 09)	25.7	27.7	(05 16)	210	31
SEA TEMP (DEG C)	25.2	(26 12)	26.1	27.5	(06 21)	213	31
AIR-SEA TEMP (DEG C)	-03.0	(13 15)	-00.4	01.7	(02 15)	210	31
PRESSURE (MBAR)	1006.7	(22 09)	1019.1	1025.6	(16 15)	211	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.4	10.5	1.9				13.8	16.5
NE		7.1	7.6					14.8	10.4
E		2.4	1.9					10.0	8.8
SE	.5	3.8	.5					4.8	8.2
S	.5	9.7	9.6	1.9				20.8	12.2
SW	.5	5.8	14.1	5.3				30.5	13.7
W		1.4	2.4	.5				4.3	13.3
NW			1.9					1.9	16.0
CALM								0	
TOTAL	1.0	30.5	51.4	7.6				100.0	12.6

MAX WIND
SPEED: 32 KNOTS
DIRECTION: 190 DEG
DAY: 12
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 211

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	27.5	50.2	18.0	4.3					1.2M	3.0M	(23 12)

JULY DATA SUMMARY 41002
AVERAGE LATITUDE 32.3N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	21.1	(04 15)	24.6	26.1	(29 18)	248	31
SEA TEMP (DEG C)	25.5	(10 12)	27.5	29.0	(20 21)	248	31
AIR-SEA TEMP (DEG C)	-06.4	(06 15)	-01.0	01.0	(11 15)	248	31
PRESSURE (MBAR)	1007.4	(28 09)	1016.2	1023.4	(21 15)	240	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4	.4					.8	7.5
NE	.8	3.2	4.4	.4				8.8	11.2
E		3.2	2.8					6.5	11.1
SE		7.7	8.9	.4				16.5	11.7
S	.4	6.5	25.8	.4				33.1	13.5
SW		7.3	19.1	2.8				29.2	14.7
W		2.4	2.0					4.4	10.7
NW		1.6	1.2					2.8	10.4
CALM	.4							.4	.0
TOTAL	1.2	31.0	63.7	4.0				100.0	12.4

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 210 DEG
DAY: 01
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	3.2	86.3	10.5						1.0M	2.5M	(23 21)

AUGUST DATA SUMMARY 41002
AVERAGE LATITUDE 32.7N AVERAGE LONGITUDE 075.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.7	(31 15)	27.1	29.6	(02 16)	248	31
SEA TEMP (DEG C)	27.7	(28 17)	28.9	31.5	(09 21)	248	31
AIR-SEA TEMP (DEG C)	-04.5	(31 15)	-01.8	00.4	(02 16)	248	31
PRESSURE (MBAR)	1002.2	(21 09)	1017.0	1029.2	(04 16)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.2	2.8					4.0	13.4
NE	.8	1.6	14.5					16.9	14.3
E	.8	4.0	10.5	.4				17.7	12.8
SE	1.6	.8	2.0					4.4	8.3
S	3.2	4.5	7.2					14.9	8.9
SW		2.8	19.3					23.0	12.0
W	.4	4.0	2.8					7.3	10.1
NW		.8	5.6					6.5	15.5
CALM	.4							.4	.0
TOTAL	7.1	15.5	68.9	.4				100.0	11.6

MAX WIND
SPEED: 22 KNOTS
DIRECTION: 070 DEG
DAY: 26
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	15.6	66.7	17.5						1.0M	2.5M	(24 21)

JULY DATA SUMMARY 41003
AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	25.0	(29 21)	27.5	29.5	(14 03)	248	31
SEA TEMP (DEG C)	26.6	(27 12)	27.6	29.1	(17 21)	248	31
AIR-SEA TEMP (DEG C)	-02.8	(29 21)	-00.3	01.6	(14 03)	248	31
PRESSURE (MBAR)	1010.8	(23 21)	1016.1	1021.2	(21 03)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	1.2						1.6	6.0
NE		2.1	2.0					4.9	9.3
E		4.3	5.3					10.6	10.3
SE	1.2	5.7	9.8					16.7	10.6
S	.4	9.8	14.2					24.4	11.2
SW	.8	7.7	11.8	.8				21.1	12.1
W		4.5	11.8					16.3	12.7
NW	.8	1.6	.8					2.8	8.1
CALM	1.6							1.6	.0
TOTAL	4.9	36.6	55.7	.8				100.0	10.9

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 240 DEG
DAY: 24
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	36.0	64.0							.9M	1.5M	(27 06)

AUGUST DATA SUMMARY 41003
AVERAGE LATITUDE 30.3N AVERAGE LONGITUDE 080.4W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	26.6	(24 12)	27.4	29.5	(04 21)	248	31
SEA TEMP (DEG C)	27.1	(26 12)	27.5	29.9	(16 21)	248	31
AIR-SEA TEMP (DEG C)	-02.0	(10 15)	-00.2	01.4	(30 21)	248	31
PRESSURE (MBAR)	1016.1	(22 21)	1019.9	1022.1	(06 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		5.2	4.4					9.7	10.7
NE	.8	5.5	7.3					16.5	10.2
E	1.6	11.7	4.4					17.7	7.8
SE	.8	5.6	1.6					8.1	7.4
S	1.6	17.7	3.6					23.0	9.1
SW	.8	6.5	4.4					11.7	9.0
W	.8	6.5	1.2					8.5	7.9
NW	.8	.8	.4					1.6	8.0
CALM	3.2							3.2	.0
TOTAL	10.5	57.1	32.3					100.0	8.6

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 060 DEG
DAY: 24
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	93.5	06.0	.4						.6M	2.0M	(26 06)

JULY DATA SUMMARY 41004
AVERAGE LATITUDE 32.5N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.7	(25 18)	27.4	29.9	(12 16)	248	31
SEA TEMP (DEG C)	26.2	(01 12)	28.1	30.2	(16 21)	248	31
AIR-SEA TEMP (DEG C)	-04.2	(25 18)	-00.7	01.2	(02 12)	248	31
PRESSURE (MBAR)	1010.1	(26 09)	1016.2	1023.5	(21 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	3.2	3.2					7.3	9.6
NE	1.2	.8	4.4					6.5	11.7
E	1.2	.8	2.8					8.1	7.2
SE	.4	10.5	3.6					14.5	8.4
S	1.6	12.1	5.6	.4				19.8	9.1
SW	.8	7.7	21.8	.4				30.6	12.8
W	.8	3.6	2.0					6.5	9.0
NW	1.6	3.6	.4					5.6	6.1
CALM	1.2							1.2	.0
TOTAL	9.7	46.8	42.7	.8				100.0	9.9

MAX WIND
SPEED: 22 KNOTS
DIRECTION: 200 DEG
DAY: 11
HOUR: 19

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	24.8	73.4	2.0						1.0M	2.5M	(11 18)

AUGUST DATA SUMMARY 41004
AVERAGE LATITUDE 32.5N AVERAGE LONGITUDE 078.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	24.0	(23 18)	27.5	29.6	(05 16)	248	31
SEA TEMP (DEG C)	25.7	(31 09)	28.2	31.5	(09 16)	248	31
AIR-SEA TEMP (DEG C)	-03.1	(23 21)	-00.7	01.5	(03 12)	248	31
PRESSURE (MBAR)	1010.4	(23 21)	1017.5	1024.1	(08 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	%	SPEED (KNOTS) 1-	11-	22-	34-	47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.6	.4					2.0	7.9
NE	.4	5.6	17.3	.8				24.2	14.1
E	.4	5.2	9.3					14.1	9.9
SE	1.2	2.0	.8					4.7	6.4
S	2.0	7.3	4.4					13.7	8.6
SW	.8	4.5	25.4					30.7	11.8
W	.4	2.4	3.2					6.0	10.2
NW	.4	.8						1.2	9.0
CALM								0	
TOTAL	4.0	29.5	60.6	.8				100.0	11.0

MAX WIND
SPEED: 23 KNOTS
DIRECTION: 050 DEG
DAY: 25
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 240

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	29.8	65.7	5.2						1.0M	2.5M	(26 06)

JULY — DATA SUMMARY — 41005

AVERAGE LATITUDE 31.7N — AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.8	(25 18)	27.7	29.8	(14 03)	248	31
SEA TEMP (DEG C)	26.3	(01 12)	28.0	29.6	(17 21)	248	31
AIR-SEA TEMP (DEG C)	-03.5	(25 12)	-00.3	01.6	(01 15)	248	31
PRESSURE (MBAR)	1010.9	(14 00)	1016.4	1022.8	(21 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.8	1.2				4.0	7.8
NE	.4	3.6	.8				4.8	8.5
E	1.6	4.0	3.6				9.3	8.1
SE	1.2	4.4	7.3	.4			13.3	10.3
S	1.6	12.1	9.7				23.4	9.7
SW	1.6	10.1	14.5	.4			26.6	11.1
W	.4	6.9	6.4				13.7	9.7
NW	.4	3.6	.8				4.8	7.8
CALM								
TOTAL	7.7	49.2	42.3	.8			100.0	9.8

NO. OF OBS: 248

MAX WIND
SPEED: 22 KNOTS
DIRECTION: 130 DEG
DAY: 11
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 243

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	26.7	71.6	1.6						1.0M	2.0M (26 00)

AUGUST — DATA SUMMARY — 41005

AVERAGE LATITUDE 31.7N — AVERAGE LONGITUDE 079.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	20.3	(25 18)	27.7	29.7	(03 03)	247	31
SEA TEMP (DEG C)	26.2	(29 06)	27.8	29.7	(21 21)	246	31
AIR-SEA TEMP (DEG C)	-06.0	(25 18)	-00.1	01.6	(29 15)	246	31
PRESSURE (MBAR)	1010.3	(22 09)	1017.5	1023.8	(06 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.0	.4				2.8	6.6
NE	.4	8.1	16.6				25.1	12.1
E	2.0	7.3	4.0				13.4	8.7
SE	1.2	4.5	.8				6.5	6.8
S	1.2	5.3	6.9				13.4	10.1
SW	.8	10.9	17.0				28.7	11.2
W	.8	4.9	3.6				9.3	9.0
NW	.4	.4					.8	4.5
CALM								
TOTAL	7.3	43.3	49.4				100.0	10.3

NO. OF OBS: 247

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 070 DEG
DAY: 16
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	25.9	64.4	9.7						1.1M	2.5M (26 03)

JULY — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.1	(17 09)	28.4	31.1	(08 18)	248	31
SEA TEMP (DEG C)	27.7	(20 12)	29.5	32.4	(08 21)	248	31
AIR-SEA TEMP (DEG C)	-04.1	(17 09)	-01.1	00.9	(19 18)	248	31
PRESSURE (MBAR)	1010.3	(24 09)	1016.0	1019.5	(10 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.8	8.1	.8				11.7	5.9
NE	1.6	4.4	.8				6.9	6.2
E	3.6	9.3	2.0	.4			15.3	7.5
SE	3.6	10.1	4.8				18.5	8.2
S	4.4	10.5	6.4	.4			21.8	8.6
SW	1.6	3.6	5.6	.4			11.3	10.9
W	2.4	3.2	2.0				7.7	7.2
NW	.4	2.8	.8				4.0	6.3
CALM	1.2						1.2	.0
TOTAL	21.8	54.4	22.6	1.2			100.0	7.7

NO. OF OBS: 248

MAX WIND
SPEED: 24 KNOTS
DIRECTION: 110 DEG
DAY: 06
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	77.7	21.9	.4						.5M	2.0M (24 21)

AUGUST — DATA SUMMARY — 42001

AVERAGE LATITUDE 25.9N — AVERAGE LONGITUDE 089.7W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	25.3	(13 15)	28.6	30.7	(10 16)	248	31
SEA TEMP (DEG C)	27.2	(11 00)	29.0	31.6	(29 21)	248	31
AIR-SEA TEMP (DEG C)	-03.4	(13 15)	-00.8	01.1	(11 00)	248	31
PRESSURE (MBAR)	1003.2	(08 12)	1015.4	1021.4	(28 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	.4	1.6				3.3	7.2
NE	2.0	.8	.4				3.3	6.6
E	2.4	12.2	8.6	1.2	1.2		25.7	11.7
SE	1.2	15.1	20.8	2.0	1.2		40.4	12.9
S	2.0	11.4	2.9	.8			17.1	8.2
SW		2.4					2.4	6.8
W	1.6	1.6					3.3	4.0
NW	.4	2.0					2.4	5.3
CALM	2.0						2.0	.0
TOTAL	13.1	46.1	34.3	4.1	2.4		100.0	10.4

NO. OF OBS: 245

MAX WIND
SPEED: 41 KNOTS
DIRECTION: 130 DEG
DAY: 09
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	65.3	29.0	3.6	1.2	2.8	1.6	.4		.9M	8.0M (08 18)

JULY — DATA SUMMARY — 42002

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	23.7	(19 18)	29.0	31.1	(01 16)	248	31
SEA TEMP (DEG C)	29.3	(07 12)	30.0	32.2	(30 00)	248	31
AIR-SEA TEMP (DEG C)	-05.6	(19 18)	-01.0	00.8	(30 15)	248	31
PRESSURE (MBAR)	1009.1	(24 09)	1015.2	1019.2	(15 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.4	3.6	.8				6.9	5.9
NE	2.8	2.0					4.8	3.4
E	4.8	12.1	3.6				20.6	7.4
SE	3.4	14.5	8.5	.4			25.8	8.7
S	3.6	12.1	11.7				27.4	8.9
SW	2.0	2.4	1.6				6.0	6.7
W	1.2	2.4	.4				4.0	6.2
NW	1.2	1.2					2.4	4.3
CALM	2.0						2.0	.0
TOTAL	22.6	50.4	26.8	.4			100.0	7.5

NO. OF OBS: 248

MAX WIND
SPEED: 23 KNOTS
DIRECTION: 140 DEG
DAY: 07
HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	73.0	26.2	.8						.6M	2.0M (27 09)

AUGUST — DATA SUMMARY — 42002

AVERAGE LATITUDE 26.0N — AVERAGE LONGITUDE 093.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	26.2	(06 21)	28.7	30.2	(03 21)	98	13
SEA TEMP (DEG C)	28.0	(31 15)	29.5	31.4	(01 21)	98	13
AIR-SEA TEMP (DEG C)	-03.6	(06 21)	-00.8	00.1	(30 15)	98	13
PRESSURE (MBAR)	1007.1	(08 21)	1015.6	1019.6	(28 18)	98	13

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N								
NE			4.1	2.1			6.2	19.8
E	2.1	9.3	15.5	2.1			27.8	13.8
SE	1.0	16.5	23.7	1.0			42.3	11.5
S	3.1	10.3	8.2				21.6	8.9
SW	1.0						1.0	1.0
W								
NW		1.0					1.0	4.0
CALM								
TOTAL	7.2	37.1	51.5	4.1			100.0	11.4

NO. OF OBS: 97

MAX WIND
SPEED: 31 KNOTS
DIRECTION: 070 DEG
DAY: 08
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 97

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	53.6	41.2	1.0	2.1	1.0	1.0			1.0M	4.0M (08 21)

JULY — DATA SUMMARY — 44002

AVERAGE LATITUDE 40.1N — AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.5	(11 12)	23.8	26.4	(31 21)	248	31
SEA TEMP (DEG C)	19.0	(01 12)	23.1	26.9	(31 21)	248	31
AIR-SEA TEMP (DEG C)	-02.0	(11 12)	00.7	03.6	(18 21)	248	31
PRESSURE (MBAR)	1002.3	(06 03)	1014.1	1021.4	(19 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	6.1	2.4				10.1	7.6
NE		1.2	1.6				2.8	9.0
E	1.2	1.6					2.8	8.9
SE	.4	5.7	1.6				7.7	8.2
S	.4	4.9	.8				6.1	6.6
SW	.4	15.4	14.6				30.4	11.1
W	1.6	13.8	13.4				28.7	10.3
NW	2.0	5.7	2.0				9.7	8.0
CALM	1.6						1.6	.0
TOTAL	9.3	54.3	36.4				100.0	9.3

NO. OF OBS: 247

MAX WIND
SPEED: 21 KNOTS
DIRECTION: 270 DEG
DAY: 23
HOUR: 03

AUGUST — DATA SUMMARY — 44002

AVERAGE LATITUDE 40.1N — AVERAGE LONGITUDE 073.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	18.6	(21 12)	23.0	26.4	(07 21)	248	31
SEA TEMP (DEG C)	20.3	(24 12)	22.8	25.6	(07 21)	248	31
AIR-SEA TEMP (DEG C)	-03.3	(21 12)	00.2	05.0	(28 21)	248	31
PRESSURE (MBAR)	1007.8	(02 06)	1015.9	1025.4	(29 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		4.1	4.1	.8			9.0	11.1
NE		.8	1.2	3.3	2.5		7.8	18.6
E	.8	2.9	2.9	1.2			7.8	13.2
SE	.4	2.0	.4				2.9	8.9
S	.4	4.1	2.5				9.4	8.4
SW	1.6	15.2	8.2				25.0	9.6
W	1.6	16.8	8.6				27.0	9.3
NW	1.6	6.6	2.0				10.2	8.1
CALM	.8						.8	.0
TOTAL	8.6	54.9	32.0	4.8			100.0	10.0

NO. OF OBS: 244

MAX WIND
SPEED: 34 KNOTS
DIRECTION: 060 DEG
DAY: 22
HOUR: 00

JULY — D A T A   S U M M A R Y — 44003

AVERAGE LATITUDE 40.8N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.7	(19 09)	15.3	16.9	(23 00)	46	7
SEA TEMP (DEG C)	11.7	(17 21)	12.8	13.9	(19 21)	46	7
AIR-SEA TEMP (DEG C)	-00.9	(19 06)	02.7	04.9	(18 06)	46	7
PRESSURE (MBAR)	1010.2	(17 21)	1016.8	1023.5	(19 15)	46	7

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 46

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	4.3						4.3	2.5
NE								
E		2.2					2.2	5.0
SE	2.2	2.2					4.3	4.0
S		13.0	15.2				28.3	10.0
SW	6.5	15.2	34.8				56.5	10.4
W		2.2					2.2	6.0
NW		2.2					2.2	7.0
CALM								
TOTAL	13.0	37.0	50.0				100.0	9.4

MAX WIND
SPEED: 17 KNOTS
DIRECTION: 210 DEG
DAY: 17
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 45

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		91.1	8.9						1.4M	2.0M (18 06)

AUGUST — D A T A   S U M M A R Y — 44003

AVERAGE LATITUDE 40.8N — AVERAGE LONGITUDE 068.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.4	(26 18)	17.1	21.5	(14 21)	163	21
SEA TEMP (DEG C)	13.1	(12 03)	15.4	21.2	(29 18)	163	21
AIR-SEA TEMP (DEG C)	-03.6	(29 18)	01.7	05.3	(12 03)	163	21
PRESSURE (MBAR)	1003.4	(16 12)	1016.4	1025.9	(29 18)	163	21

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 162

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	3.7	6.2	1.2			12.3	12.4
NE	.6	6.2	8.0				14.8	11.5
E		3.1	3.1				6.2	9.9
SE	1.2	3.7	1.2				6.2	8.3
S	1.9	13.0	4.9				19.8	8.8
SW	1.2	9.9	2.5				13.6	7.5
W	3.7	6.8	3.7	.6			14.8	6.0
NW	.6	8.6	3.1				12.3	8.0
CALM								
TOTAL	10.5	54.9	32.7	1.9			100.0	9.1

MAX WIND
SPEED: 24 KNOTS
DIRECTION: [illegible]
DAY: 24
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 163

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	17.8	52.8	20.2	3.7	5.5				1.5M	4.5M (23 09)

JULY — D A T A   S U M M A R Y — 45001

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 087.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.1	(04 15)	08.8	14.5	(31 18)	246	31
SEA TEMP (DEG C)	02.8	(07 09)	05.0	10.6	(31 21)	247	31
AIR-SEA TEMP (DEG C)	01.2	(17 09)	03.7	08.0	(14 15)	246	31
PRESSURE (MBAR)	1003.7	(15 06)	1013.1	1022.5	(06 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 245

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	4.9	2.4				8.2	8.2
NE	.4	1.2	1.2				2.9	8.4
E	1.2	2.9	.4				4.5	6.1
SE	1.2	6.9	1.6				9.8	7.8
S		13.9	5.3				19.2	8.7
SW	3.3	12.2	3.3				18.8	7.4
W	2.4	23.7	2.4				28.6	7.3
NW	1.2	6.1	.8				8.2	6.5
CALM								
TOTAL	10.6	71.6	17.6				100.0	7.6

MAX WIND
SPEED: 17 KNOTS
DIRECTION: 070 DEG
DAY: 16
HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	89.4	10.6							.4M	1.5M (25 15)

AUGUST — D A T A   S U M M A R Y — 45001

AVERAGE LATITUDE 46.0N — AVERAGE LONGITUDE 087.6W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.1	(07 15)	14.2	17.5	(30 03)	248	31
SEA TEMP (DEG C)	08.6	(06 06)	11.8	16.0	(31 21)	248	31
AIR-SEA TEMP (DEG C)	00.1	(15 12)	02.4	04.9	(08 15)	248	31
PRESSURE (MBAR)	1000.5	(21 12)	1013.1	1025.3	(16 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.0	7.3	1.2				10.5	6.9
NE	1.2	3.6	.4				5.2	5.8
E	1.2	6.5	.8				8.5	7.6
SE	1.6	7.7	8.1				17.3	9.5
S	2.0	14.1	6.5				22.6	8.6
SW	1.2	8.1	6.0				15.3	9.4
W	1.2	9.3	2.8				13.3	8.2
NW	.8	5.2	.4				6.5	6.5
CALM	.8						.8	.0
TOTAL	12.1	61.7	26.2				100.0	8.2

MAX WIND
SPEED: 17 KNOTS
DIRECTION: 350 DEG
DAY: 26
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 244

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	63.5	34.0	2.5						.7M	2.5M (22 00)

JULY — D A T A   S U M M A R Y — 45002

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.4	(01 21)	15.6	20.4	(11 21)	247	31
SEA TEMP (DEG C)	08.5	(01 15)	14.5	19.3	(31 18)	247	31
AIR-SEA TEMP (DEG C)	-03.5	(26 12)	01.1	06.3	(06 21)	247	31
PRESSURE (MBAR)	1006.3	(15 09)	1015.3	1024.7	(06 15)	105	19

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 244

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.6	9.4	4.1				15.2	8.3
NE	1.2	4.9	2.5				8.6	7.8
E	2.5	6.6					9.0	5.1
SE	1.6	1.6					3.3	4.5
S	2.5	9.4	3.3				15.2	7.3
SW	.4	14.3	13.9				28.7	10.5
W	2.9	9.8	.4				13.1	5.7
NW	1.2	4.1	1.2				6.6	6.6
CALM	.4						.4	.0
TOTAL	14.3	60.2	25.4				100.0	7.8

MAX WIND
SPEED: 19 KNOTS
DIRECTION: 210 DEG
DAY: 24
HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 246

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	82.5	17.5							.5M	1.5M (25 12)

AUGUST — D A T A   S U M M A R Y — 45002

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 086.3W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.8	(27 12)	18.3	21.1	(02 00)	248	31
SEA TEMP (DEG C)	17.6	(18 09)	18.5	19.9	(03 21)	248	31
AIR-SEA TEMP (DEG C)	-04.2	(27 12)	-00.1	02.3	(02 00)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	4.0	6.0	.4			11.3	11.6
NE	.8	4.8	2.8				8.5	10.0
E	.8	4.8	5.2				10.9	10.2
SE	.4	3.6	2.0				6.0	9.1
S	1.6	6.5	9.3				17.3	10.0
SW	.4	13.7	16.5				30.6	13.7
W	.8	6.0	3.6				10.5	9.1
NW		4.0	.8				4.8	8.0
CALM								
TOTAL	5.6	47.6	46.4	.4			100.0	10.1

MAX WIND
SPEED: 22 KNOTS
DIRECTION: 340 DEG
DAY: 12
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	57.1	42.1	.8						.7M	2.0M (25 21)

JULY — D A T A   S U M M A R Y — 45003

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 082.8W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.0	(02 09)	14.8	20.2	(30 21)	248	31
SEA TEMP (DEG C)	04.3	(02 12)	13.2	19.1	(30 21)	248	31
AIR-SEA TEMP (DEG C)	-03.2	(26 15)	01.6	07.9	(07 06)	248	31
PRESSURE (MBAR)	1005.7	(17 03)	1013.4	1022.4	(06 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 245

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	2.4	.4				3.3	6.3
NE	.8	4.9					5.7	5.7
E	1.2	3.3	.4				4.9	5.9
SE	2.9	2.9	1.2				6.9	6.1
S	.8	17.6	6.1				24.5	8.2
SW	1.2	10.6	.8				12.7	6.5
W	3.3	18.0	2.9				24.1	7.0
NW	1.2	12.2	3.3				16.7	8.6
CALM	1.2						1.2	.0
TOTAL	13.1	71.8	15.1				100.0	7.2

MAX WIND
SPEED: 18 KNOTS
DIRECTION: 310 DEG
DAY: 05
HOUR: 18

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 247

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	91.9	8.1							.4M	1.5M (05 21)

AUGUST — D A T A   S U M M A R Y — 45003

AVERAGE LATITUDE 45.3N — AVERAGE LONGITUDE 082.8W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	15.4	(16 09)	19.1	23.0	(08 21)	247	31
SEA TEMP (DEG C)	16.8	(16 15)	18.6	20.9	(08 00)	247	31
AIR-SEA TEMP (DEG C)	-02.4	(28 06)	00.6	02.7	(09 00)	247	31
PRESSURE (MBAR)	1003.2	(03 00)	1014.6	1025.2	(23 15)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES — NO. OF OBS: 248

DIR	<4	4-10	11-21	22-33	34-47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	3.2	1.6				5.6	9.6
NE			2.0				2.0	14.0
E	2.0	6.5	3.2				11.7	8.0
SE	1.6	7.3	4.4				13.3	8.8
S	2.8	13.3	6.0				22.2	8.5
SW	2.4	8.9	2.4				13.7	8.4
W	3.2	8.1	2.4				13.7	7.0
NW	2.4	6.0	8.1				16.5	9.8
CALM	1.2						1.2	.0
TOTAL	16.5	53.2	30.2				100.0	8.3

MAX WIND
SPEED: 19 KNOTS
DIRECTION: 080 DEG
DAY: 28
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) — NO. OF WAVE OBS: 241

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	70.5	29.0	.4						.6M	2.0M (28 12)

JULY D A T A S U M M A R Y 45004

AVERAGE LATITUDE 47.2N AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.0	(02 09)	09.6	17.0	(08 03)	247	31
SEA TEMP (DEG C)	03.4	(03 12)	06.4	13.1	(31 21)	248	31
AIR-SEA TEMP (DEG C)	00.0	(26 09)	03.3	13.3	(08 03)	247	31
PRESSURE (MBAR)	1004.1	(15 06)	1013.3	1023.4	(04 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	5.3	1.2				6.9	7.7
NE	1.2	1.6					2.8	4.4
E	1.2	4.9					6.1	5.5
SE	.8	8.1	1.6				10.6	7.5
S	1.6	17.5	4.1				23.2	7.8
SW	2.0	7.7	2.8				12.6	7.3
W		15.4	1.2				16.7	6.7
NW	.8	15.9	.8				17.5	6.8
CALM	1.6						1.6	.0
TOTAL	9.8	78.5	11.6				100.0	6.9

NO. OF OBS: 246

MAX WIND SPEED: 16 KNOTS DIRECTION: 340 DEG DAY: 05 HOUR: 15

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	96.8	3.2							.9M	1.5M (05 18)

NO. OF WAVE OBS: 248

AUGUST D A T A S U M M A R Y 45004

AVERAGE LATITUDE 47.2N AVERAGE LONGITUDE 086.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.1	(03 15)	16.0	20.3	(23 21)	248	31
SEA TEMP (DEG C)	12.0	(03 12)	14.8	17.2	(29 00)	248	31
AIR-SEA TEMP (DEG C)	-01.6	(14 09)	01.2	05.2	(09 21)	248	31
PRESSURE (MBAR)	1001.6	(05 09)	1013.5	1024.9	(28 15)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		6.0	2.4				8.5	9.2
NE	.4	4.0	.8				5.2	8.4
E	.4	7.3	2.4				10.1	8.2
SE	.8	10.9	2.8				14.5	8.5
S	1.2	14.5	7.3	.8			23.8	9.2
SW	.8	6.0	1.6				8.5	8.4
W	2.0	11.3	2.0				15.3	6.6
NW	1.6	7.7	2.8				12.1	8.1
CALM	2.0						2.0	.0
TOTAL	9.3	67.7	22.2	.8			100.0	8.1

NO. OF OBS: 248

MAX WIND SPEED: 32 KNOTS DIRECTION: 200 DEG DAY: 24 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	82.4	17.4	2.2						.6M	2.0M (05 06)

NO. OF WAVE OBS: 96

JULY D A T A S U M M A R Y 45005

AVERAGE LATITUDE 41.7N AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.3	(03 15)	23.0	29.4	(21 00)	205	27
SEA TEMP (DEG C)	19.0	(01 12)	23.5	26.8	(26 21)	204	27
AIR-SEA TEMP (DEG C)	-04.2	(30 15)	-00.5	03.6	(21 00)	204	27
PRESSURE (MBAR)	1007.5	(17 06)	1013.9	1019.3	(24 15)	205	27

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	2.0	7.8	.5				10.2	6.8
NE	2.0	7.8	1.0				10.7	6.1
E	4.4	5.9	1.0				10.7	5.3
SE	2.4	12.7	2.4				17.5	7.1
S	4.9	12.2	2.4				19.5	5.8
SW		14.6	4.4				19.0	8.2
W	1.5	7.3	2.0				10.7	7.3
NW		4.4	.5				4.9	6.7
CALM	1.5						1.5	.0
TOTAL	18.5	67.3	14.1				100.0	6.6

NO. OF OBS: 205

MAX WIND SPEED: 17 KNOTS DIRECTION: 150 DEG DAY: 31 HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	95.1	4.9							.4M	1.0M (31 15)

NO. OF WAVE OBS: 203

AUGUST D A T A S U M M A R Y 45005

AVERAGE LATITUDE 41.7N AVERAGE LONGITUDE 082.5W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	17.7	(16 12)	23.4	28.1	(08 21)	211	28
SEA TEMP (DEG C)	22.0	(18 00)	24.3	26.6	(09 21)	211	28
AIR-SEA TEMP (DEG C)	-09.0	(16 12)	-00.9	02.6	(01 00)	211	28
PRESSURE (MBAR)	1007.9	(12 00)	1016.4	1028.0	(24 15)	211	28

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.5	5.2	6.2				11.9	10.6
NE	2.9	5.7					8.6	5.2
E	1.4	7.1	1.0				9.5	6.7
SE	1.4	9.0	3.3				13.8	7.7
S	2.4	10.5	1.4				14.3	6.8
SW	1.9	15.2	4.8				21.9	8.4
W	1.9	8.7	2.9				10.5	7.6
NW	1.0	3.3	1.4				5.7	8.1
CALM	3.8						3.8	.0
TOTAL	17.1	61.9	21.0				100.0	7.5

NO. OF OBS: 210

MAX WIND SPEED: 20 KNOTS DIRECTION: 230 DEG DAY: 14 HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	84.8	15.2							.4M	1.0M (31 09)

NO. OF WAVE OBS: 211

JULY D A T A S U M M A R Y 46001

AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	08.5	(07 18)	10.9	13.6	(26 03)	244	31
SEA TEMP (DEG C)	09.6	(01 15)	11.4	14.0	(26 03)	247	31
AIR-SEA TEMP (DEG C)	-02.2	(07 18)	-00.5	00.6	(30 21)	244	31
PRESSURE (MBAR)	0997.5	(30 03)	1013.8	1023.4	(11 06)	244	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	6.6	2.0				9.0	8.4
NE	.4	5.7	3.3				9.4	9.0
E	.4	5.3	4.1				9.8	9.8
SE	.4	2.5	.8				3.7	7.9
S	.4	4.1	10.2	2.5			17.2	14.5
SW		4.5	15.6				20.1	13.0
W		5.7	15.2	.4			21.3	13.1
NW		3.7	4.5				8.2	10.6
CALM	1.2						1.2	.8
TOTAL	3.3	38.1	55.7	2.9			100.0	11.6

NO. OF OBS: 244

MAX WIND SPEED: 27 KNOTS DIRECTION: 160 DEG DAY: 03 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	35.3	41.2	23.5						1.2M	2.5M (31 21)

NO. OF WAVE OBS: 68

AUGUST D A T A S U M M A R Y 46001

AVERAGE LATITUDE 56.0N AVERAGE LONGITUDE 148.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.5	(31 21)	12.1	13.6	(06 03)	248	31
SEA TEMP (DEG C)	11.4	(19 09)	12.3	12.9	(16 00)	248	31
AIR-SEA TEMP (DEG C)	-01.6	(31 21)	-00.2	01.0	(31 03)	248	31
PRESSURE (MBAR)	1000.2	(31 21)	1015.9	1027.5	(06 09)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	.8	2.4				4.0	11.0
NE			.4				.4	13.0
E	.4	4.0	2.8				7.3	12.6
SE		2.0	6.9	.4			9.3	14.5
S		5.2	9.7	.4			15.3	12.3
SW	.8	9.4	16.9	6.0			33.2	16.6
W	1.2	9.3	19.0	2.8			32.3	13.5
NW		1.6	1.2				2.8	10.4
CALM	.4						.4	.0
TOTAL	3.6	27.4	59.3	9.7			100.0	13.7

NO. OF OBS: 248

MAX WIND SPEED: 27 KNOTS DIRECTION: 240 DEG DAY: 31 HOUR: 21

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	6.5	49.6	31.0	7.7	5.2				1.8M	5.5M (18 18)

NO. OF WAVE OBS: 248

JULY D A T A S U M M A R Y 46002

AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.8	(02 09)	14.4	16.3	(25 00)	248	31
SEA TEMP (DEG C)	14.3	(02 09)	15.7	16.8	(31 21)	248	31
AIR-SEA TEMP (DEG C)	-02.7	(21 15)	-01.3	-00.3	(23 00)	248	31
PRESSURE (MBAR)	1014.1	(09 12)	1022.6	1028.3	(17 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.6	60.1	.8			64.5	15.4
NE	.8	1.6	.8				2.8	9.0
E		.8					.8	7.1
SE	.8	.8					.8	4.5
S	.8	2.8	1.6				4.4	8.2
SW	.8	1.2	2.8				4.4	9.9
W	1.2	3.6	1.6				6.5	8.3
NW	.8	7.7	6.9				15.3	10.2
CALM	.4						.4	.0
TOTAL	4.4	21.4	73.4	.8			100.0	13.2

NO. OF OBS: 248

MAX WIND SPEED: 23 KNOTS DIRECTION: 010 DEG DAY: 28 HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY	4.4	74.8	15.7						1.4M	2.5M (29 06)

NO. OF WAVE OBS: 248

AUGUST D A T A S U M M A R Y 46002

AVERAGE LATITUDE 42.5N AVERAGE LONGITUDE 130.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	14.2	(13 12)	15.9	17.6	(02 00)	248	31
SEA TEMP (DEG C)	16.6	(04 15)	17.1	18.1	(30 00)	248	31
AIR-SEA TEMP (DEG C)	-02.7	(12 18)	-01.2	00.2	(01 15)	248	31
PRESSURE (MBAR)	1016.7	(10 12)	1022.3	1027.0	(24 21)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	SPEED (KNOTS) <4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.6	63.7	4.4			69.8	16.5
NE			.8				.8	19.5
E								
SE								
S			.4				.4	14.0
SW		.4	.4				.8	11.0
W		6.8	.4				8.9	9.6
NW		4.0	17.3				21.4	13.4
CALM								
TOTAL		12.5	83.1	4.4			100.0	18.1

NO. OF OBS: 248

MAX WIND SPEED: 26 KNOTS DIRECTION: 360 DEG DAY: 18 HOUR: 06

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS)

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-5.5	6-7.5	8-9.5	>9.5	MEAN	MAX (DA HR)
% FREQUENCY		67.3	28.6	4.0					1.7M	3.0M (24 06)

NO. OF WAVE OBS: 248

JULY 46003

DATA SUMMARY

AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	05.9	(22 15)	08.9	11.4	(26 08)	129	17
SEA TEMP (DEG C)	09.0	(15 21)	10.1	11.5	(26 06)	129	17
AIR-SEA TEMP (DEG C)	-04.2	(22 15)	-01.1	01.3	(2C 21)	129	17
PRESSURE (MBAR)	1008.1	(30 03)	1016.3	1024.2	(26 18)	129	17

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		3.9					3.9	6.6
NE		2.3					2.3	5.7
E	.8	.8	.8				2.3	8.0
SE	1.6	2.3	1.6				5.4	6.7
S		.8	4.7				5.4	14.3
SW	.8	6.2	18.8	4.7			30.2	15.8
W	1.6	5.4	23.3	3.9			34.1	14.6
NW	.8	10.9	9.7				18.3	9.7
CALM								
TOTAL	5.4	32.6	53.5	8.5			100.0	12.7

NO. OF OBS: 129

MAX WIND
SPEED: 26 KNOTS
DIRECTION: 240 DEG
DAY: 30
HOUR: 00

AUGUST 46003

DATA SUMMARY

AVERAGE LATITUDE 52.0N AVERAGE LONGITUDE 156.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	07.9	(10 20)	11.1	15.0	(25 16)	248	31
SEA TEMP (DEG C)	10.2	(01 21)	11.5	12.9	(26 00)	248	31
AIR-SEA TEMP (DEG C)	-03.7	(11 06)	-00.5	03.1	(25 16)	248	31
PRESSURE (MBAR)	1003.3	(19 21)	1019.2	1029.3	(2C 09)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		.4					.4	6.0
NE								
E		.4		.4			.8	6.0
SE			.8	1.6	.4		2.8	16.1
S			3.6	10.9	.8		15.3	15.6
SW		.8	6.0	36.3	11.7		53.2	17.8
W		.8	4.8	11.7	6.0		23.4	15.9
NW		3.2	2.8	2.0			8.0	8.3
CALM								
TOTAL		5.2	18.9	62.9	19.0		100.0	16.3

NO. OF OBS: 248

MAX WIND
SPEED: 30 KNOTS
DIRECTION: 220 DEG
DAY: 17
HOUR: 12

JULY 46004

DATA SUMMARY

AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	06.3	(02 18)	12.0	15.9	(3C 03)	248	31
SEA TEMP (DEG C)	10.1	(01 15)	11.9	13.2	(26 00)	248	31
AIR-SEA TEMP (DEG C)	-01.9	(22 18)	00.1	03.1	(17 09)	248	31
PRESSURE (MBAR)	1011.8	(09 03)	1020.7	1031.7	(17 00)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.2	3.2				4.4	12.0
NE	.8						.8	2.5
E		.4	.4				.8	11.6
SE		1.2	.8				2.0	10.9
S		1.6	4.8				6.1	13.0
SW		7.3	20.6	1.2			32.7	15.0
W	.8	7.7	21.8	1.6			31.9	13.4
NW		2.8	14.5				17.4	13.1
CALM								
TOTAL	1.6	17.7	77.8	2.8			100.0	13.6

NO. OF OBS: 248

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 250 DEG
DAY: 26
HOUR: 21

AUGUST 46004

DATA SUMMARY

AVERAGE LATITUDE 51.0N AVERAGE LONGITUDE 136.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	11.0	(2C 18)	13.1	16.4	(21 21)	248	31
SEA TEMP (DEG C)	12.6	(01 18)	13.3	13.9	(26 03)	248	31
AIR-SEA TEMP (DEG C)	-02.3	(20 18)	-00.1	03.1	(25 16)	248	31
PRESSURE (MBAR)	1010.0	(22 18)	1020.6	1032.5	(23 18)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.8	1.6	5.6	.8			8.5	12.3
NE	.8	.8	.8				1.6	10.0
E		.8	.8				.0	11.8
SE								
S		2.7	2.4	.8			5.2	14.0
SW		.8	8.1	.8			9.3	16.0
W	.8	4.6	21.8	3.2			30.6	15.8
NW		4.4	34.7	8.8			48.0	14.7
CALM								
TOTAL	2.0	14.5	73.8	9.7			100.0	15.7

NO. OF OBS: 248

MAX WIND
SPEED: 32 KNOTS
DIRECTION: 280 DEG
DAY: 23
HOUR: 00

JULY 46005

DATA SUMMARY

AVERAGE LATITUDE 48.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.3	(01 12)	13.4	16.C	(31 21)	247	31
SEA TEMP (DEG C)	12.4	(04 18)	14.2	16.1	(31 00)	247	31
AIR-SEA TEMP (DEG C)	-02.2	(01 12)	-00.6	00.6	(27 00)	247	31
PRESSURE (MBAR)	1012.7	(03 09)	1021.7	1028.5	(17 18)	247	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	1.2	17.1	10.6				28.9	11.8
NE	.8						.8	2.8
E								
SE								
S			.4	3.2			3.6	13.0
SW		.4	4.7	5.7			10.9	16.5
W			10.5	16.2			26.7	11.1
NW		.8	17.0	14.2			32.0	9.7
CALM								
TOTAL	1.2	18.2	42.9	53.6			100.0	10.6

NO. OF OBS: 247

MAX WIND
SPEED: 19 KNOTS
DIRECTION: 340 DEG
DAY: 12
HOUR: 09

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 184

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	5-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	5.4	85.9	8.7						1.2M	2.5M	(12 09)

AUGUST 46005

DATA SUMMARY

AVERAGE LATITUDE 48.0N AVERAGE LONGITUDE 131.0W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	13.2	(26 23)	14.8	16.2	(26 00)	248	31
SEA TEMP (DEG C)	14.7	(31 12)	15.2	16.0	(02 20)	235	31
AIR-SEA TEMP (DEG C)	-02.C	(26 05)	-00.5	01.2	(29 21)	236	31
PRESSURE (MBAR)	1015.6	(11 03)	1021.3	1028.C	(29 21)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		1.6	30.6	.4			32.7	15.8
NE	.4						.4	3.0
E		1.2	.4				1.6	8.0
SE								
S			.4				.4	11.1
SW	.4	1.2	1.2				2.8	9.1
W	.4	4.4	12.1				16.4	12.2
NW		4.2	38.7	2.0			42.7	13.6
CALM								
TOTAL	1.2	12.4	83.5	2.0			100.0	13.2

NO. OF OBS: 248

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 330 DEG
DAY: 18
HOUR: 12

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 248

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	5-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		46.4	42.7	8.5	.4				1.4M	4.0M	(18 18)

JULY 46010

DATA SUMMARY

AVERAGE LATITUDE 46.2N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	10.8	(04 03)	14.1	22.5	(21 18)	246	31
SEA TEMP (DEG C)	09.5	(31 18)	14.2	19.C	(21 21)	245	31
AIR-SEA TEMP (DEG C)	-03.1	(04 03)	-00.1	07.4	(21 18)	245	31
PRESSURE (MBAR)	1012.6	(22 00)	1019.6	1024.6	(17 00)	246	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N		4.9	39.4				44.3	13.1
NE		.4	.4				.8	6.5
E		.8					.8	6.0
SE								
S		1.2	6.1	1.2			8.5	15.4
SW		4.1	2.8				6.9	9.6
W	.4	8.9	3.2				13.0	9.1
NW		4.9	17.2				21.1	11.8
CALM	.4						.4	.0
TOTAL	1.2	33.3	69.2	1.2			100.0	11.9

NO. OF OBS: 246

MAX WIND
SPEED: 25 KNOTS
DIRECTION: 190 DEG
DAY: 04
HOUR: 00

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 91

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	5-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY	7.3	75.6	14.6		2.4				1.3M	4.0M	(04 00)

AUGUST 46010

DATA SUMMARY

AVERAGE LATITUDE 46.2N AVERAGE LONGITUDE 124.2W

MEANS AND EXTREMES	MIN	(DA HR)	MEAN	MAX	(DA HR)	NO. OF OBS	DAYS WITH DATA
AIR TEMP (DEG C)	09.5	(10 15)	13.2	15.4	(16 21)	248	31
SEA TEMP (DEG C)	09.9	(03 12)	12.4	15.7	(22 00)	248	31
AIR-SEA TEMP (DEG C)	-03.8	(25 21)	-00.2	04.1	(27 00)	248	31
PRESSURE (MBAR)	1011.2	(18 03)	1019.4	1023.7	(20 21)	248	31

WIND - % FREQUENCIES, MEANS AND EXTREMES

DIR	<4	4- 10	11- 21	22- 33	34- 47	>47	TOTAL %	MEAN SPEED (KNOTS)
N	.4	6.9	29.0				36.3	12.3
NE		.4	.4				.8	10.0
E			.8				.8	11.6
SE								
S		1.6	11.7				13.3	13.0
SW		3.6	6.9				10.5	10.7
W	.4	7.3	6.0				13.7	9.7
NW	.4	6.0	16.3				24.2	10.6
CALM	.4						.4	.0
TOTAL	1.6	25.2	70.2				100.0	11.4

NO. OF OBS: 248

MAX WIND
SPEED: 70 KNOTS
DIRECTION: 350 DEG
DAY: 06
HOUR: 03

WAVES - % FREQUENCIES, MEAN AND EXTREME (METERS) NO. OF WAVE OBS: 89

HEIGHT (M)	<1	1-1.5	2-2.5	3-3.5	4-4.5	5-7.5	8-9.5	>9.5	MEAN	MAX	(DA HR)
% FREQUENCY		65.9	25.3	3.4					1.4M	3.6M	(21 03)

Selected Gale and Wave Observations, North Atlantic

July and August 1980

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves?		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH ATLANTIC OCEAN		JULY															
AMERICAN LEGEND	KFEY	2	48.5 N	35.2 W	06	20	35	10 NM	03	1018.6	15.6	13.0	5	6.5	20	9	10
AMERICAN RANGER	KNRW	6	38.1 N	65.3 W	18	27	28	10 NM	01	1005.8	27.2	20.5	7	19.5	26	12	24.5
SEALAND GALLOWAY	KHLX	6	40.8 N	65.7 W	18	27	35	2 NM	45	1000.0	15.5	16.0	5	6.5	27	8	8
AMERICAN COURIER	WAXH	6	38.1 N	61.9 W	18	22	35	5 NM	02	1006.8	25.6	26.7	8	10	22	6	10
STOVE TRADER	SIHJ	6	38.4 N	59.9 W	18	20	40	5 NM	03	1009.5	26.0		5	13	21	< 6	23
MEONIA	OXON	8	13.3 N	74.7 W	06	07	M 36	10 NM	00	1010.0	27.5						
NORTHWIND WAGB 282	NRFJ	8	59.1 N	44.9 W	18	04	M 40	1 NM	07	1004.0	7.0	7.0	6	13			
EXPORT PATRIOT	WCJY	9	36.0 N	13.5 W	12	04	35	> 25 NM	02	1022.0	21.1	20.0	2	5	35	>13	6.5
SEALAND LEADER	WSNM	13	40.0 N	51.0 W	00	20	M 35	5 NM	02	1019.6	23.9	24.0	4	5	20	7	8
LASH PACIFICO	WIEE	14	39.8 N	52.0 W	18	21	35	10 NM	02	1020.0	26.7	21.1	2	6.5	21	< 6	11.5
TFL EXPRESS	9VPU	16	50.4 N	29.5 W	06	23	M 38	5 NM	61	1011.5	15.0	16.0	5	3			
TRANSCOLUMBIA	KPBG	17	55.1 N	13.4 W	06	25	35	2 NM	50	1002.5	12.3	12.3	XX	3	25	8	10
TFL EXPRESS	9VPU	17	48.6 N	42.6 W	12	23	M 41	5 NM	10	1009.5	15.0	13.0	5	3	25	6	5
GULF TRADER	KRHI	17	48.7 N	07.5 W	18	26	35	1 NM	51	1020.1	15.0	15.5	2	6.5	26	< 6	10
TFL EXPRESS	9VPU	18	46.6 N	52.9 W	12	23	M 37	200 YD	45	1010.0	11.5	7.0					
TILLIE LYKES	WDOP	20	49.1 N	05.4 W	12	32	41	10 NM	91	1005.8	15.0	15.0	5	8	32	7	11.5
TRANSCOLUMBIA	KPBQ	20	48.0 N	43.2 W	18	27	40	5 NM	02	1014.5	10.7	12.2	4	8	27	< 6	6.5
AMERICAN CHALLENGER	WMEP	23	43.8 N	32.5 W	12	01	40	5 NM	50	1003.4	18.3	21.1	5	13	03	6	16.5
NURA DEL MAR	EHRZ	24	44.0 N	22.7 W	12	30	40	10 NM	02	1003.0	18.4	22.4	10	18	30	10	18
HUDSON T-AG 184	NNNU	25	11.2 N	78.9 W	18	05	35	10 NM	01	1012.9	27.8	28.3	3	6.5	05	< 6	6.5
AMERICAN CHALLENGER	WMFP	26	38.6 N	55.6 W	06	23	35	1 NM	65	1015.0	23.3	25.6	3	8	25	6	19.5
SEALAND LEADER	WSNM	26	47.4 N	34.8 W	06	32	M 35	5 NM	02	1016.5	14.0	16.0	8	11.5	32	11	13
AMERICAN ARCHER	KFCS	26	50.4 N	25.0 W	12	07	35	5 NM	50	1011.0	13.9	14.4	5	6.5	07	9	11.5
NURA DEL MAR	EHRZ	26	44.7 N	34.1 W	12	30	35	10 NM	02	1024.0	17.5	22.4	10	19.5	27	10	19.5
AMERICAN ACE	KFCV	26	48.4 N	26.9 W	18	20	45	5 NM	15	1014.6	15.0	16.7	4	10	20	7	14.5
SEALAND PACER	KSLB	26	49.3 N	22.5 W	18	05	40	5 NM	15	1009.1	13.9	12.8	6	10	05	11	19.5
EXPORT LEADER	WCJV	26	49.4 N	18.5 W	18	07	35	5 NM	02	1008.5	13.3	15.3	6	8	05	7	10
SEALAND LEADER	WSNM	27	48.3 N	28.1 W	00	02	M 35	5 NM	02	1024.5	14.0	17.0	4	10	01	11	14.5
EXPORT LEADER	WCJV	27	49.6 N	13.0 W	06	36	38	10 NM	02	1007.5	13.3	16.1	5	8	06	7	10
TILLIE LYKES	WDOP	28	49.3 N	14.5 W	06	33	40	2 NM	50	1006.1	13.5	14.0	5	8	33	7	8
T F L LIBERTY	9VDD	28	37.2 N	74.7 W	18	09	M 20	10 NM	00	1017.5	25.0	26.0	8	34.5			
TILLIE LYKES	WDOP	29	45.6 N	27.0 W	18	34	40	5 NM	15	1023.4	16.5	16.0	5	5	34	7	8
NURA DEL MAR	EHRZ	30	41.2 N	63.3 W	12	24	40	5 NM	25	1019.0	24.0	20.0	7	16.5	24	7	16.5
WALTER RICE	KCSE	31	15.4 N	76.7 W	06	08	35	2 NM	05	1011.0	28.5	27.3	8	8	08	10	11.5
GREAT LAKES VESSELS																	
MESABI MINER	9687	8	44.9 N	86.8 W	12	11	M 35	10 NM	03		14.0	14.0	2	1.5			
		AUG.															
EXPORT LEADER	WCJV	4	49.6 N	15.6 W	06	23	35	5 NM	20	1002.4	16.7	16.1	6	8	04	7	10
CHEVRON SOUTH AMERICA	SMOZ	4	12.7 N	64.2 W	21	19	M 35	10 NM	02	1008.5	27.0	29.0	7	10			
SONG OF NORWAY	LNVP	5	18.9 N	67.3 W	09	08	M 45	5 NM	17	1011.2	28.1	28.0	8	13			
JACKSONVILLE	KWAH	5	17.7 N	70.0 W	12	06	54	1 NM	07	1003.0	25.0	33.3	10	32.5	06	10	32.5
CHEVRON SOUTH AMERICA	SMOZ	5	14.5 N	67.8 W	12	15	M 43	10 NM	15	1009.5	27.0	29.5	8	13			
MORMACSUN	WMBK	5	17.8 N	68.5 W	12	09	45	1 NM	62	1005.1	25.0	27.2	7	14.5	11	8	24.5
TASSO	DNAT	5	21.1 N	96.5 W	12	15	35	2 NM	97	1007.2	24.8	29.0	5	10	12	6	11.5
EXXON JAMESTOWN	KIYG	5	19.9 N	74.1 W	18	24	40	10 NM	64	1012.5	25.0	30.6	XX	8	04	7	10
JACKSONVILLE	KWAH	6	17.9 N	69.2 W	00	11	41	5 NM	07	1012.0	26.3	31.7	8	29.5	11	8	29.5
MORMACSUN	WMBK	6	17.5 N	69.2 W	00	11	35	5 NM	02	1008.2	27.8	27.2	6	16.5	12	7	29.5
ACUSHNET WAGO 167	NNHA	6	23.5 N	81.9 W	18	07	35	5 NM	03	1014.0	29.4	29.5	6	10			
EXPORT LEADER	WCJV	6	45.2 N	43.4 W	18	29	35	5 NM	20	1011.2	20.0	22.4	6	8	25	6	11.5
DAVID P REYNOLDS	SLWL	6	19.5 N	83.1 W	21	02	36	10 NM	03	1003.0	29.0	30.0	6	10	02	8	10
DAVID P REYNOLDS	SLWL	7	19.4 N	82.4 W	00	01	40	5 NM	03	0996.8	28.0	30.0	8	11.5	02		16.5
TILLIE LYKES	WDOP	7	24.5 N	81.0 W	00	05	40	10 NM	03	1012.5	29.0	30.0	7	19.5	05	7	19.5
MARINE CHEMICAL TRANSPRT	KVNZ	7	24.3 N	81.9 W	00	09	38	10 NM	02	1013.0	30.0	30.5	3	10	09	< 6	11.5
TEXAS TRADER	KTHC	7	28.2 N	84.8 W	12	08	40	5 NM	25	1010.5	29.4	28.9	3	11.5	08	7	13
KEYSTONER	KIGR	7	23.3 N	85.5 W	21	08	64	200 YD	81	1000.0	26.7	29.4	9	23	09	9	24.5
TEXAS TRADER	KTHC	8	24.3 N	82.1 W	00	11	35	5 NM	02	1012.5	30.6	28.3	3	10			
KEYSTONER	KIGR	8	23.3 N	85.1 W	03	09	60	2 NM	17	1000.5	28.3	29.4	6	19.5	09	10	24.5
SOCONY VACUUM	KIGL	8	22.0 N	94.1 W	12	30	40	10 NM	03	1005.1	26.7	30.0	2	5	09	8	3
DOCEANGRA	PPFF	8	15.0 N	49.0 W	12	16	M 35	200 YD	64	1006.5	28.0	27.0					
COLORADO	KWFE	8	27.9 N	91.3 W	18	08	45	10 NM	03	1010.8	30.1	30.0	5	8	11	9	14.5
ARCO SAG RIVER	WLDF	8	27.8 N	91.8 W	18	07	35	5 NM	02	1008.0	29.0	29.5	4	5	09	7	16.5
NEW JERSEY SUN	KEAL	8	27.0 N	90.6 W	21	10	50	5 NM	02	1007.1	29.2	30.0	XX	6.5	10	10	10
ARCO HERITAGE	KAHA	8	27.6 N	91.2 W	21	08	M 36	5 NM	62	1011.0	25.0	29.4	6	8	13	11	13
OVERSEAS ALEUTIAN	KFGK	8	27.5 N	91.9 W	22	08	45	5 NM	01	1006.8	28.3	31.7	5	24	07	8	14.5
NEW JERSEY SUN	KEAL	9	26.9 N	90.4 W	00	12	55	5 NM	02	1007.8	29.2	29.4	XX	6.5	12	10	10
SOCONY VACUUM	KIGL	9	22.2 N	92.8 W	00	24	40	5 NM	02	0999.0	26.7	28.9	3	5	27	9	10
COLORADO	KWFE	9	28.0 N	90.7 W	00	09	40	5 NM	02	1009.5	30.0	30.0	5	8	11	9	14.5
ARCO HERITAGE	KAHA	9	27.8 N	90.4 W	03	10	M 35	5 NM	02	1012.0	28.8	29.5					
OVERSEAS ALEUTIAN	KFGK	9	27.2 N	91.1 W	05	11	50	10 NM	01	1007.8	27.9	29.5	8	24	07	8	14.5
EDGAR M QUEENY	KEOC	9	24.1 N	95.7 W	12	30	75	200 YD	59	0998.2	26.7	27.8	XX	13	XX		26
ADM WM M CALLAGHAN	KGYE	9	26.4 N	22.0 W	12	24	35	10 NM	02	1002.5	13.6	12.8	3	6.5	24	8	13
RICHARD	SLIK	9	27.8 N	94.4 W	12	09	48	2 NM	14	1001.0	29.0	30.0	5	8	12		23
MONMOUTH	KFLF	9	27.8 N	95.1 W	15	09	40	2 NM	18	1001.4	29.4	29.4	5	8	09	9	13
COMET	NJZP	9	36.5 N	25.7 W	18	22	36	5 NM	07	0998.0	12.8	11.7	4	13	23	< 6	19.5
MONMOUTH	KFLF	10	27.4 N	94.5 W	03	10	45	5 NM	07	1002.0	28.3	29.4	4	6.5	10	8	11.5
RICHARD	SLIK	10	27.5 N	93.1 W	06	11	45	5 NM	02	1007.0	26.0	30.0	5	8	13		21
TFL EXPRESS	9VPU	11	50.5 N	17.2 W	06	31	M 38	10 NM	01	1008.7	15.0	16.8	5	3			
ADM WM M CALLAGHAN	KGYE	12	46.9 N	46.6 W	00	31	35	5 NM	02	1008.3	11.1	11.7					
AMERICAN LEGACY	KFGJ	12	48.3 N	45.9 W	06	31	35	5 NM	01	1009.2	11.1	10.6	4	6.5	XX		8
STAGHOUND	KAFQ	12	48.8 N	43.8 W	18	31	35	5 NM	25	1013.4	11.7	18.9	5	6.5	32	10	13
TFL EXPRESS	9VPU	12	50.0 N	33.4 W	18	26	M 40	5 NM	81	0991.0	15.0	15.8	5	10	26	6	10
GORINGUEN	KPCV	13	33.3 N	71.2 W	00	22	40	5 NM	21	1012.9	26.6	28.3	9	29.5	23	8	29.5
LASH PACIFICO	WIEE	13	42.2 N	30.1 W	06	31	40	10 NM	01	1014.0	20.1	20.1	5	5	29	< 6	6.5
TFL EXPRESS	9VPU	13	48.5 N	37.7 W	11	31	M 48	10 NM	02	1013.0	13.5	16.8					
SEA BELLS	9VGM	13	48.0 N	31.6 W	12	28	M 48	5 NM	02	1006.0	15.5	19.0	8	5	28	8	5
SEA BELLS	9VGM	14	46.3 N	39.8 W	18	22	M 38	2 NM	25	1002.0	20.1	17.0	6	3	22	7	3
LASH PACIFICO	WIEE	14	43.1 N	44.6 W	18	27	40	5 NM	03	1002.7	24.4	21.1	4	10	27	< 6	10
LASH PACIFICO	WIEE	15	43.1 N	47.0 W	00	27	45	10 NM	01	1006.8	18.9	21.1	5	10	27	< 6	13
SEA BELLS	9VGM	15	45.4 N	43.0 W	06	25	M 40	2 NM	01	1000.1	16.8	21.0	6	3	25	6	3
EXPORT PATRIOT	WCJY	16	40.1 N	57.3 W	18	22	35	5 NM	05	1000.3	26.1	25.6	2	5	21	< 6	11.5
SEA BELLS	9VGM	17	42.6 N	53.8 W	00	23	M 40	.5 NM	03	0992.5	19.0	20.0	5	1.5	23	< 6	1.5
DART EUROPE	ONDA	17	45.5 N	50.0 W	06	18	M 37	2 NM	81	0986.1	19.5	13.0					

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility	Present Weather code	Pressure mb	Temperature °C		Sea Waves?		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.	n. mi.			Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH ATLANTIC OCEAN		AUG.															
AMERICANA	IBPA	17	36.9 N	58.9 W	06	27	42	10 NM	68	1004.8	24.8	27.8					
EXPORT PATRIOT	WCJV	17	40.3 N	65.9 W	18	35	40	10 NM	02	1013.5	21.1	24.4	3	6.5	34	6	14.5
SEALAND GALLOWAY	KHLX	17	39.0 N	65.0 W	18	01	45	10 NM	02	1010.6	22.2	23.3	5	16.5	01	6	19.5
AMERICAN ARCHER	KFCS	17	47.7 N	46.5 W	18	21	35	2 NM	11	0999.8	14.2		9	18			
AMERICANA	IBPA	18	36.0 N	65.2 W	00	32	36	10 NM	01	1017.8	24.0	26.5	5	1.5	34	10	10
AMERICAN ARCHER	KFCS	18	49.0 N	40.8 W	06	23	35	5 NM	02	1004.2	13.7	16.7					
SEALAND GALLOWAY	KHLX	18	39.8 N	60.4 W	06	02	35	10 NM	03	1010.2	17.7	23.3	4	16.5	03	6	19.5
NORTHWIND ARGO 282	NRFJ	18	59.3 N	42.8 W	15	03	M 46	.5 NM	07	0996.7	5.5	8.6	6	10			
SEALAND GALLOWAY	KHLX	19	41.8 N	48.8 W	12	04	40	.25 NM	62	1007.5	15.6	21.7	4	26	04	>13	36
GULF TRADER	KRHI	19	48.8 N	39.1 W	12	03	35	.25 NM	45	0993.9	18.8	19.4	3	6.5	05	6	8
AMERICAN ARGOSY	KFCX	19	45.9 N	39.6 W	13	27	35	1 NM	45	0999.7	18.8	17.2		10	14	< 6	13
PIONEER CONTENDER	WMEC	19	54.3 N	15.2 W	18	26	35	5 NM	10	1018.0	17.3	14.0	5	10	27	12	16
PIONEER CONTENDER	WMEC	20	53.7 N	16.8 W	00	24	35	5 NM	50	1021.0	15.5	13.9	5	10	27	7	10
AMERICAN ARGOSY	KFCX	20	45.1 N	49.7 W	12	33	45	2 NM	44	1004.0	11.1	12.8	3	16.5	34	< 6	24.5
ALGENIB	9VDR	22	37.9 N	64.6 W	12	06	M 58	.5 NM	62	0999.5	24.3	27.5			XX		24
THOMAS NELSON	WEIL	22	41.7 N	59.3 W	18	09	35	5 NM	01	1011.4	22.1	24.4	3	6.5	07	< 6	16.5
RESOLUTE	KFDZ	23	39.2 N	69.6 W	12	01	40	5 NM	01	1008.1	20.0	25.8	5	13	XX		14.5
SEASPEED ARABIA	DSEG	23	40.1 N	68.7 W	20	02	M 35	5 NM	02	1010.4	23.0						
SEASPEED ARABIA	DSEG	24	39.9 N	62.3 W	06	06	M 35	10 NM	01	1005.5	24.0	23.0	9	8			
OYVI PACIFIC	LMCV	24	43.2 N	37.5 W	23	25	40	5 NM	03	0994.0	22.0		5	13			
EXPORT FREEDOM	WCJS	25	36.2 N	51.0 W	06	25	45	2 NM	15	1008.0	25.5	25.8	3	8	25	< 6	10
SEASPEED ARABIA	DSEG	25	39.5 N	53.3 W	0	36	M 40	2 NM	25	1003.0	23.0						
ITALICA	IBKL	25	39.5 N	40.6 W	..	31	40	10 NM	03	1001.5	22.0	25.5	4	8			
ITALICA	IBKL	26	39.4 N	39.0 W	00	30	36	10 NM	01	1001.5	22.0	25.5	4	8			
MALAYAN PEEFER	DUHF	27	48.9 N	39.9 W	14	24	37	2 NM	02	0998.0	15.0						
GREAT LAKES VESSELS																	
J L MAUTHE	9868	5	47.0 N	86.4 W	06	18	M 43	5 NM	29		20.0	20.0	3	5			
ENVIRONMENTAL BUOY																	
42001		08	25.2N	89.7W	14	13	M 23			1003.5	84.7	89.0	4	17.0			

\+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 25 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

Selected Gale and Wave Observations, North Pacific

July and August 1980

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility	Present Weather code	Pressure mb.	Temperature °C		Sea Waves*			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.	n. mi.			Air	Sea	Period sec.	Height ft.		Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		JULY																
CRYSTAL STAR	DSTG	1	53.6 N	174.3 E	00	01	M 35	1 NM	40	1001.0	9.0	5.0	3	8		01	10	16.5
SINALOA	DXNS	1	37.3 N	144.1 E	12	05	M 36	10 NM	13	1008.0	19.0	24.2	7	16.5				
TOYOTA NO.22	S6FA	3	53.1 N	150.8 W	00	28	M 38	1 NM	61	1018.5	10.0	8.0	5	5		28	< 6	5
SEATRAIN VALLEY FORGE	9VPV	3	34.3 N	143.0 E	06	19	M 42	1 NM	64	0997.5	25.0	25.0	6	14.5				
MONSHU GLORIA	A8PJ	3	50.0 N	177.8 W	06	13	M 28	50 YD	41	1011.0	8.0	8.0	5	10		12	6	26
MARINER	SLEF	3	51.6 N	174.1 W	12	09	35	< 50 YD	47	1013.0	9.0	5.0	4	8		09	10	10
TOYOTA MARU 12	JBJO	3	49.5 N	133.6 W	21	34	M 38	10 NM	01	1012.0	12.5	13.0	5	11.5		33	7	13
CHEVRON NAGASAKI	A8BK	4	11.5 N	54.7 E	06	23	M 40	10 NM	02	1007.0	26.5	28.9	12	19.5		23	12	19.5
MONSHU GLORIA	A8PJ	4	51.5 N	164.7 W	18	18	M 26	50 YD	41	1016.0	11.0	9.5	5	10		18	< 6	26
PRESIDENT TAFT	WLDT	4	33.4 N	178.9 W	18	25	35	.25 NM	64	1013.0	24.5	20.5	4	5		22	< 6	10
MARINER	SLEF	4	53.4 N	162.4 W	22	18	35	50 YD	47	1013.4	12.0	8.0	5	8		18	< 6	10
MONSHU GLORIA	A8PJ	5	51.7 N	160.4 W	06	20	M 28	.5 NM	43	1016.0	10.0	11.0	6	10		19	7	41
AUSTRAL MOON	WE7T	5	29.5 N	122.0 W	18	35	38	10 NM	02	1018.0	17.3	17.4	XX	8		36		5
MARINER	SLEF	5	54.4 N	154.1 W	21	18	40	2 NM	43	1011.0	13.0	8.0	6	10		18	6	10
MARINER	SLEF	6	54.5 N	152.9 W	00	18	40	50 YD	45	1011.4	13.0	8.0	6	10		18	6	10
AMERICAN APOLLO	KEOD	7	40.0 N	165.3 E	06	30	35	5 NM	02	1003.0	16.1	16.7	10	8				
SIMBA	OWEC	7	39.2 N	179.2 W	12	22	M 38	1 NM	81	1007.0	19.2	18.5						
UNITED SPIRIT	SMKM	7	43.8 N	167.0 W	12	19	M 42	200 YD	49	1010.5	15.0	13.0	12	13		19	8	13
MARINER	SLEF	7	54.7 N	139.0 W	13	25	35	5 NM	03	1015.0	15.0	9.0	4	6.5		24	< 6	6.5
PRESIDENT CLEVELAND	KGXA	8	33.8 N	176.5 W	18	19	36	2 NM	65	1004.5	23.9	21.1	XX	10		21	6	10
LEO	SLMT	8	48.5 N	166.7 W	22	23	M 35	50 YD	54	1006.5	14.3	11.0	2	10		22	< 6	10
PRESIDENT CLEVELAND	KGXA	9	32.8 N	176.9 W	00	20	40	1 NM	65	1003.7	24.5	22.2	XX	11.5		20	6	11.5
PACIFIC ERA	ELUD	9	38.1 N	175.4 W	00	20	35	2 NM	07	0998.7	20.0	20.0	7	13		17	11	16.5
AMERICAN APOLLO	KEOD	9	44.3 N	171.8 W	06	16	36	.5 NM	42	1004.2	15.0	12.2		13		16	13	13
AMERICAN APOLLO	KEOD	10	44.8 N	162.7 W	00	16	35	2 NM	10	1017.5	17.2	12.8	7	8		16	12	11.5
SEALAND EXCHANGE	KFOU	10	26.1 N	123.2 E	06	18	35	10 NM	02	1001.5	28.9	27.2	4	8		18	8	10
MIDGETT WHEC 726	NHWR	10	54.1 N	164.5 W	06	10	35	.25 NM	63	1004.5	8.2	3.9	4	8				
PRESIDENT TYLER	WE7M	10	48.7 N	179.8 W	12	02	M 35	2 NM	40	0999.0	8.3	7.2						
PRESIDENT MC KINLEY	WWFZ	10	27.0 N	125.7 E	18	18	38	10 NM	02	1004.8	27.8	27.8						
PRESIDENT PIERCE	WURV	10	48.5 N	163.5 W	18	17	40	2 NM	63	1003.0	11.2	7.3	5	16.5		22	8	19.5
SIMBA	OWEC	10	31.2 N	160.7 E	18	26	M 36	10 NM	01	1006.0	25.8	22.0	7	10		26	7	11.5
SINCERE NO 3	ELRT	11	48.4 N	175.2 W	00	36	M 24	50 YD	45	0995.0	10.5	8.0	8	24.5		34	9	23
TOYOTA MARU 10	JAMI	11	42.2 N	161.5 W	06	16	M 36	.5 NM	53	1012.5	19.0	14.5	8	18		18	8	14.5
LNG TAURUS	WDZW	11	19.4 N	121.0 E	06	19	M 35	5 NM	02	1007.0	29.5	26.7	6	16.5		20	9	23
BEISHU MARU	JDBD	11	51.6 N	154.4 W	12	18	M 35	2 NM	03	1016.0	10.5	8.0	6	6.5		24	8	16.5
GOLDEN GATE BRIDGE	JPZD	11	45.6 N	155.5 W	12	17	M 35	2 NM	44	1019.5	15.0	13.5	4	10		24	8	16.5
TOYOTA NO.22	S6FA	11	34.5 N	139.2 E	18	24	M 50	2 NM	20	0999.0	25.0	22.0	3	5		27	8	5
SEALAND DEFENDER	KGJB	11	50.0 N	170.7 W	18	24	M 38	5 NM	40	0992.5	9.5	10.0	4	6.5		21	< 6	6.5
PRESIDENT PIERCE	WURV	11	48.3 N	176.1 W	18	32	35	5 NM	02	1008.5	6.2	6.7	4	10		34	8	18
TOYOTA NO.22	S6FA	12	34.5 N	137.7 E	00	01	M 42	10 NM	03	1001.2	24.5	23.0	5	5		26	8	5
PRESIDENT ADAMS	KAAV	12	38.3 N	146.3 E	00	11	35	2 NM	63	1000.3	20.6	18.9	5	10		14	6	10
SINCERE NO 3	ELRT	12	48.6 N	166.4 W	00	23	M 38	5 NM	45	1000.5	9.7	9.0	7	24.5		27	8	23
EASTERN TREASURE	6ZSP	13	39.3 N	151.7 E	00	05	M 35	5 NM	15	0996.5	15.5	20.0	2	13		05	< 6	19.5
JAPAN RAINBOW	JPVJ	13	52.1 N	158.0 W	06	24	M 35	2 NM	11	1016.0	10.0	8.0	5	8		24	< 6	8
PACIFIC ERA	ELUD	13	35.5 N	154.7 E	12	29	35	5 NM	01	1006.5	20.5	20.0	5	13		29	8	16.8
ANNA MAERSK	OYKS	13	42.1 N	157.6 E	12	06	35	1 NM	63	0990.6	12.3		6	13				
PRESIDENT HARRISON	WCJI	13	43.4 N	145.7 W	18	28	35	10 NM	02	1030.5	15.6	14.4	3	5				
PRESIDENT ADAMS	KAAV	13	46.3 N	163.3 E	18	08	40	2 NM	50	1007.0	8.9	9.4	5	8		11	7	10
PRESIDENT PIERCE	WURV	14	43.0 N	156.7 E	00	36	40	2 NM	51	1013.9	13.9	10.6	4	10		10	7	13
PRESIDENT MC KINLEY	WWFZ	14	40.3 N	156.7 E	06	33	38	10 NM	02	1008.4	16.7	17.7	2	11.5		06	8	16.5
KOREAN COMMANDER	DTPF	14	43.5 N	162.0 E	06	36	33	50 YD	20	0993.5	10.0	10.0	10	32.5		36	>13	32.5
PRESIDENT ADAMS	KAAV	14	48.7 N	171.9 E	12	09	40	2 NM	50	1014.6	6.7	6.1	5	10		11	7	13
SEATRAIN YORKTOWN	DSNP	14	35.8 N	141.7 E	18	19	M 36	10 NM	02	1002.0	26.5	24.0						
PRESIDENT ADAMS	KAAV	15	50.2 N	178.7 W	06	12	36	2 NM	02	1016.0	11.1	6.7	4	8		15	7	6.5
PRESIDENT MC KINLEY	WWFZ	15	42.5 N	169.5 E	12	26	36	2 NM	51	0998.0	10.0	10.0						
TOYOTA NO.22	S6FA	16	38.0 N	149.6 E	06	06	M 40	5 NM	03	1007.0	19.0	19.0	6	3		06	< 6	5
PRESIDENT ADAMS	KAAV	16	51.1 N	165.3 W	06	08	38	1 NM	53	1010.0	7.8	8.3	4	6.5		14	6	8
MONSHU GLORIA	A8PJ	16	52.5 N	149.6 W	18	20	M 34	50 YD	47	1023.0	11.0	10.0	5	6.5		22	6	32.5
TOYOTA NO.22	S6FA	17	38.4 N	155.0 E	00	02	M 35	5 NM	02	1008.5	17.0	19.0	6	1.5		04	< 6	3
SIENA	DXFU	17	47.9 N	159.6 W	12	20	M 35	2 NM	53	1011.2	13.6							
TOYOTA NO.22	S6FA	18	38.9 N	163.1 E	00	04	M 35	.5 NM	12	1007.7	16.5	17.0	3	1.5		07	6	3
AMERICA SUN	WNFJ	18	39.6 N	124.6 W	18	02	M 41	5 NM	05	0982.1	15.0	11.1	2	3		01	9	11.5
AMERICA SUN	WNFJ	19	41.0 N	125.5 W	00	33	M 40	2 NM	41	1016.2	16.7	14.5	6	5		33	6	5
GLACIER BAY	KACF	19	41.0 N	126.0 W	00	34	48	10 NM	00	1018.5	15.6	13.4	3	14.5		34	6	19.5
NEPTUNE DIAMOND	9VYT	20	42.4 N	124.9 W	06	35	M 40	1 NM	02	1015.0	13.5		6	6.5		35	10	11.5
CHEVRON ARIZONA	KGRE	20	42.6 N	125.3 W	18	35	M 40	1 NM	12	1014.8	15.0		4	6.5		25	7	8
LNG CAPRICORN	KHLN	21	20.2 N	122.1 E	06	14	M 51	5 NM	18	0994.9	29.9	28.3	3	10		16	< 6	13
SEATRAIN YORKTOWN	DSNP	21	41.2 N	154.5 E	06	12	M 38	1 NM	64	1011.3	17.1	16.0	7	11.5		13	9	11.5
CRESSIDA	3FTB	24	52.6 N	170.6 E	06	14	M 35	.5 NM	28	1013.0	10.0	8.7	5	11.5		14	>13	11.5
BUNGA MELAWIS	9MUT	24	38.7 N	148.3 E	18	20	M 30	5 NM	03	1010.0	24.0	21.0	4	13		XX		26
EXXON NEW ORLEANS	WNOM	24	39.1 N	124.5 W	18	33	M 40	5 NM	02	1012.2	17.2	11.7	5	8		31	< 6	6.5
KENAI	WSVB	24	40.0 N	125.4 W	18	34	30	5 NM	01	1015.2	14.4	10.0	8	8		36	12	24.5
BUNGA MELAWIS	9MUT	25	37.3 N	145.4 E	06	23	M 40	200 YD	27	1007.0	23.0	20.0	1	19.5		23	12	26
PRINCE WILLIAM SOUND	WSDX	25	39.4 N	127.2 W	18	36	M 35	10 NM	02	1019.8	17.7	15.6	9	8		35	< 6	10
PRESIDENT TRUMAN	WLPL	25	39.7 N	127.0 W	18	36	35	10 NM	02	1016.7	16.1	14.0	5	6.5		32	11	13
RUSH WHEC 723	NLVS	25	42.6 N	125.3 W	18	31	M 40	5 NM	01	1017.4	16.0	16.7	3	1.5		33	6	5
RUSH WHEC 723	NLVS	26	42.9 N	125.8 W	00	31	M 35	5 NM	02	1020.1	17.9	16.2	3	1.5		33	6	5
PRESIDENT TRUMAN	WLPL	26	40.5 N	128.8 W	00	36	36	5 NM	02	1021.7	15.7	15.7	3	6.5		32	12	11.5
PRINCE WILLIAM SOUND	WSDX	26	38.1 N	126.1 W	00	36	M 35	5 NM	01	1014.2	16.7	14.0	2	10		30	< 6	13
PRESIDENT GRANT	WEZD	26	37.6 N	127.1 W	18	35	M 35	10 NM	02	1016.5	16.1	13.8	4	10		04	6	11.5
EASTERN ROYAL	JMZR	27	52.8 N	178.0 E	00	22	M 35	2 NM	02	1023.5	9.8	9.0	5	6.5		23	8	11.5
MARINER	SLEF	27	54.1 N	168.1 W	11	24	35	.25 NM	21	1018.0	11.0	7.0	5	10		24	6	10
TONSINA	KJOG	27	41.7 N	126.8 W	12	36	35	5 NM	02	1011.4	15.6	12.8	5	10				
GLACIER BAY	KACF	27	41.3 N	126.4 W	18	35	37	5 NM	07	1012.5	17.8	9.5	4	6.5		36	6	16.5
WASHINGTON WOOD	JEOV	27	54.2 N	163.2 W	18	26	M 37	10 NM	01	1016.0	11.5	10.4	6	8		28	6	13
GLACIER BAY	KACF	28	42.6 N	127.4 W	00	01	48	5 NM	07	1016.0	16.7	9.4	3	10		01	6	19.5
JAPAN APOLLO	JK7L	28	54.1 N	178.9 W	12	22	M 36	2 NM	02	1012.5	11.0		6	11.5		25	6	11.5
WASHINGTON WOOD	JEOV	28	53.9 N	172.9 W	18	24	M 37	.5 NM	41	1014.5	11.5	8.3	7	13		24	7	13
MARINER	SLEF	28	51.9 N	179.0 W	18	18	40	< 50 YD	47	1017.0	10.0	7.0	6	10		18	6	10
ARCO JUNEAU	KSPG	29	40.2 N	125.5 W	00	36	35	5 NM	05	1009.5	18.4	10.0	3	6.5		36	< 6	10
ALVA MAERSK	OZSD	29	21.0 N	107.4 W	00	14	36	10 NM	02	1010.4	29.5		8	13		13	11	21
PRESIDENT JOHNSON	WYMS	29	52.7 N	142.6 W	06	26	40	10 NM	02	1012.8	11.3	12.2	7	6.5		27	8	6.5
WASHINGTON WOOD	JEOV	29	53.6 N	176.9 W	06	26	M 40	5 NM	41	1010.0	9.5	7.5	6	8		26	6	8
MOBIL ARCTIC	KSPY	29	22.0 N	110.5 W	12	12	M 35	5 NM	00	1005.5	28.7	24.0	3	6.5		12	6	6.5

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb	Temperature °C		Sea Waves?			Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Dir. 10°	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		JULY																
MARINER	SLEF	29	50.1 N	174.6 E	15	22	48	< 50 YD	47	1014.5	11.0	8.0	7	14.5	22	7	13	
EXXON PHILADELPHIA	WNFJ	29	41.1 N	126.2 W	18	35	M 36	10 NM	02	1014.2	17.6	14.0	5	6.5	36	10	8	
AMERICA SUN	WNEJ	29	41.2 N	126.0 W	18	01	M 38	5 NM	00	1014.2	16.0	13.8	4	6.5	36	9	14.5	
TOYOTA MO.22	S6FA	29	23.6 N	112.3 W	18	02	M 42	5 NM	29	1006.3	27.0	25.0	3	3	13	7	10	
HANJIN INCHEON	D8OC	29	50.5 N	167.9 W	22	27	M 27	5 NM	02	1017.8	13.0	10.0	5	8	26	9	32.5	
TOYOTA NO.22	S6FA	30	22.9 N	111.4 W	00	02	M 42	2 NM	65	1006.0	26.8	23.0	3	3	13	7	10	
AMERICA SUN	WNEJ	30	42.3 N	127.0 W	00	01	M 36	5 NM	02	1016.2	16.3	15.6	5	6	01	9	13	
MARINER	SLEF	30	49.1 N	170.8 E	03	22	40	< 50 YD	45	1015.5	11.5	8.0	7	14.5	22	7	13	
PRESIDENT JOHNSON	WVHS	30	54.1 N	157.0 W	06	24	35	5 NM	03	1002.5	11.7	11.7	6	18	25	6	10	
GLACIER BAY	KACF	30	56.4 N	141.0 W	06	18	35	2 NM	10	1001.8	12.8	11.2	3	5	23	8	13	
HANJIN INCHEON	D8OC	30	50.1 N	179.2 W	23	25	M 20	5 NM	02	1017.0	12.0	10.0	3	5	24	8	24.5	
MARINER	SLEF	31	45.8 N	160.0 E	16	20	40	.25 NM	43	1005.5	15.0	11.0	6	11.5	20	6	11.5	
		AUG.																
HANJIN INCHEON	D8OC	1	49.5 N	169.2 E	00	23	M 28	2 NM	44	1004.8	13.0	9.0	5	8	22	10	29.5	
MARINER	SLEF	1	44.8 N	157.8 E	01	19	40	2 NM	25	1010.4	18.0	11.0	7	14.5	19	6	13	
PRESIDENT JOHNSON	WVHS	1	52.7 N	179.9 W	18	35	50	5 NM	01	1003.2	10.0	8.9	7	11.5	35	< 6	11.5	
PACIFIC ENTERPRISE	WGJA	1	53.1 N	177.5 W	18	24	40	5 NM	10	0993.6	8.9	8.3	6	23				
BLUE OCEAN	JKGH	1	49.8 N	174.5 W	18	18	M 36	.5 NM	43	1012.5	10.0	10.0	7	6.5	21	7	6.5	
GOLDENSARI II	9VVS	2	33.9 N	140.9 E	12	04	M 42	1 NM	52	1006.8	25.0	24.8	5	6.5	04	< 6	10	
LNG AQUARIUS	WSKJ	2	33.1 N	137.4 E	12	05	M 36	5 NM	03	1004.5	24.0	27.2	3	6.5	06	8	10	
ASHLEY LYKES	WBAE	2	27.8 N	148.0 E	12	14	35	10 NM	02	1006.5	30.0	27.2	3	5	14	8	19.5	
MARINER	SLEF	2	39.8 N	148.2 E	14	20	40	.25 NM	68	1011.5	23.8	20.0	6	13	18	6	13	
TOYOTA NO.22	S6FA	2	12.2 N	91.4 W	18	02	M 37	10 NM	62	1011.5	29.8	27.0	4	8	18	< 6	8	
IRIS ISLAND	JPHG	2	54.4 N	166.3 W	18	29	M 40	5 NM	02	1018.8	9.8	8.8						
MARINER	SLEF	3	38.2 N	145.6 E	02	20	45	.5 NM	43	1011.0	25.0	20.0	7	14.5	19	8	16.5	
SAN DIEGO	WSVR	3	36.8 N	124.4 W	12	33	M 47	5 NM	02	1010.2	13.9	13.3	3	6.5	32	< 6	8	
A T ALASKA	WFOE	3	36.3 N	124.3 W	12	32	35	5 NM	05	1009.8	14.0	14.4	8	11.5	32	8	11.5	
ASHLEY LYKES	WBAE	3	24.2 N	147.8 E	12	18	35	5 NM	02	1004.8	26.7	24.4	4	8				
PRINCE WILLIAM SOUND	WSDX	3	57.7 N	143.0 W	18	27	M 38	10 NM	01	1012.2	15.5	14.2	8	10	26	12	11.5	
SAN DIEGO	WSVR	4	41.2 N	126.5 W	00	36	M 36	5 NM	02	1014.6	17.8	12.2	3	6.5	36	< 6	10	
NEPTUNE CRYSTAL	9VNW	4	42.2 N	140.0 W	06	07	M 35	5 NM	02	1030.0	15.8	16.9	3	3	31	6	3	
QUEENS WAY BRIDGE	JMJE	4	45.1 N	150.7 W	12	21	M 37	.5 NM	43	1009.5	20.0	19.0	8	13	22	8	16.5	
SEATRAIN VALLEY FORGE	9VPV	4	38.4 N	141.7 E	18	02	M 42	2 NM	62	1004.0	24.5	24.0						
SEATRAIN VALLEY FORGE	9VPV	5	36.1 N	143.9 E	00	04	M 35	2 NM	03	1004.5	25.0	26.0	6	10	XX		11.5	
QUEENS WAY BRIDGE	JMJE	5	44.0 N	148.9 W	00	22	M 37	1 NM	61	1011.0	20.5	19.5	8	13	22	9	14.5	
SINALOA	OXNS	5	37.9 N	155.7 E	18	20	M 35	5 NM	02	1001.5	26.0	25.5	10	16.5				
CHARLES LYKES	KLHR	5	34.7 N	141.8 E	18	05	35	5 NM	50	1001.7	23.3	25.6	3	5	05	6	13	
EXXON NORTH SLOPE	KHLQ	6	16.2 N	94.6 W	00	10	40	10 NM	16	1006.3	26.9	26.7	4	10	10	013	10	
CHARLES LYKES	KLHR	6	33.9 N	144.9 E	06	01	35	5 NM	62	0996.5	25.0	24.4	3	6.5	01	7	13	
SANTA ADELA	KNCS	6	14.0 N	101.4 W	18	22	37	10 NM	62	1008.2	28.6	27.5	4	5	25	7	10	
SEALAND FINANCE	WJMS	7	27.8 N	125.3 E	00	24	40	5 NM	02	0990.9	27.2	27.8	3	16.5	24	6	13	
SANTA ADELA	KNCS	7	18.4 N	105.6 W	12	09	40	5 NM	25	1001.7	25.3	24.7	4	5	09	7	16.5	
PRESIDENT MADISON	WCIP	8	38.2 N	149.6 E	12	02	35	5 NM	02	1006.5	20.0	22.2	3	8	03	6	11.5	
WESTERN SUN	KEMJ	9	19.5 N	111.8 W	00	27	45	< 50 YD	65	0995.3	-	26.7	5	8	27	7	14.5	
PRESIDENT PIERCE	WURV	9	49.4 N	165.0 E	18	17	35	.5 NM	46	1014.0	12.2	8.3	4	11.5	22	7	16.5	
EXXON BENICIA	KPNL	10	23.0 N	112.0 W	00	12	M 38	10 NM	02	0999.2	27.2	26.7	4	6	17	< 6	19.5	
OLGA TOPIC	A8CE	10	21.0 N	115.7 W	00	24	40	5 NM	25	1010.3	24.0	26.0	8	10				
PRINCE OF TOKYO	A8SJ	10	51.8 N	168.0 E	21	25	M 35	200 YD	42	1012.0	10.0	10.8	7	10	25	7	10	
PRESIDENT JEFFERSON	WPGE	11	51.9 N	133.6 W	06	31	35	5 NM	00	1015.0	13.3	12.2	5	10	31	< 6	6	
PRINCE OF TOKYO	A8SJ	11	49.2 N	161.0 E	21	24	M 35	.25 NM	48	1009.5	11.0	11.0	6	8	24	6	8	
MAUI	WSLN	12	37.2 N	124.4 W	04	34	M 36	5 NM	07	1011.2	15.0	16.2	4	3	35	8	8	
NEPTUNE CRYSTAL	9VNW	13	50.0 N	130.7 W	06	30	M 41	5 NM	02	1019.0	14.0	14.2						
AIDA	SJBA	14	32.3 N	158.3 E	00	28	40	200 YD	97	0985.7	26.0	25.5	5	19.5	19	6	21	
NEPTUNE CRYSTAL	9VNW	14	52.2 N	144.5 W	06	26	M 42	.25 NM	47	1011.5	12.0	12.0						
KURE	6ZAE	14	31.8 N	163.2 E	12	18	M 30	5 NM	07	1008.0	27.0	27.5	7	16.5	18	7	29.5	
JUTHLANDIA	ELXV	14	52.0 N	143.6 W	12	29	35	5 NM	24	1013.5	12.0	8.8						
EXXON PHILADELPHIA	WNFJ	14	40.5 N	125.2 W	18	36	M 40	5 NM	02	1014.5	15.0	12.2	2	3	35	< 6	6.5	
PRESIDENT HOOVER	WTST	15	39.6 N	150.2 E	18	07	38	10 NM	15	1011.9	17.2	22.8	4	6.5	07	7	11.5	
SEALAND PATRIOT	KHRF	15	35.0 N	168.7 E	18	26	M 44	200 YD	02	0994.0	26.0	25.0	9	19.5				
JUTHLANDIA	ELXV	15	53.5 N	154.0 W	18	25	40	2 NM	05	1009.0	12.0	8.9	6	6.5	25	< 6	6.5	
SEALAND PATRIOT	KHRF	16	35.8 N	171.2 E	00	22	M 42	.5 NM	05	0996.5	26.0	23.0	9	19.5	22	11	19.5	
MOBIL ARCTIC	KSPY	16	53.6 N	138.3 W	06	27	M 38	10 NM	02	1010.5	12.8	12.8	3	6	27	< 6	10	
JUTHLANDIA	ELXV	16	53.9 N	158.4 W	06	25	35	5 NM	02	1009.2	11.5	8.4	7	6.5	25	< 6	6.5	
MARUNA MARU	JJKG	17	46.5 N	170.5 W	00	21	M 38	.5 NM	21	1004.8	17.0	13.5	8	13				
MOBIL ARCTIC	KSPY	17	57.7 N	142.7 W	00	24	M 37	10 NM	02	0998.3	12.2	12.8	5	6.5	24	< 6	8	
SEALAND DEFENDER	KGJB	17	47.6 N	173.2 W	00	16	M 45	.5 NM	43	0992.2	15.5	14.0	8	13	18	9	31	
PACGLORY	SLZB	17	49.1 N	174.8 W	00	14	M 37	200 YD	46	0999.6	11.0	9.0		6.5	18	8	11.5	
CRESSIDA	3FYD	17	48.5 N	170.9 W	06	23	M 35	2 NM	10	1004.0	13.0	1.2	8	19.5	23	8	19.5	
VAN TRIUMPH	6ZJP	17	50.8 N	170.3 W	06	20	M 45	.25 NM	05	0990.0	11.0	10.0						
SURVEYOR	WTES	17	54.7 N	165.1 W	06	13	M 39	10 NM	02	0997.0	10.3	10.0	4	5	08	< 6	11.5	
BLUE OCEAN	JKGH	17	51.9 N	137.0 W	06	24	M 40	2 NM	07	1018.0	15.0	14.0	5	6.5	24	< 6	6.5	
PACIFIC VENTURE	WOVS	17	48.0 N	165.9 W	06	21	M 46	1 NM	07	1015.1	17.0	11.0	6	19.5	21	9	23	
SEATRAIN YORKTOWN	D5WP	17	38.1 N	148.5 E	06	09	M 36	1 NM	02	1010.8	23.3	20.0	5	14.5	06	10	14.5	
PRESIDENT CLEVELAND	KGXA	17	38.8 N	147.8 E	12	09	35	10 NM	02	1010.5	22.2	22.2	5	8	07	8	10	
MARINER	SLEF	17	39.4 N	147.6 E	14	09	45	1 NM	26	1010.0	22.0	20.0	9	19.5	09	9	14.5	
EXXON PHILADELPHIA	WNFJ	17	56.8 N	141.7 W	18	29	M 36	> 25 NM	01	1012.5	19.0	13.9	2	5	28	< 6	8	
JUTHLANDIA	ELXV	17	54.3 N	167.8 W	18	25	35	5 NM	51	1000.0	8.4	2.4	6	6.5	25	12	32.5	
BELLMAN	9VUP	17	52.2 N	130.1 W	18	32	M 36	5 NM	02	1009.0	15.0	14.0	4	8	31	6	8	
BELLMAN	9VUP	18	50.5 N	131.4 W	00	31	M 35	5 NM	01	1015.0	15.5	14.0	4	10	31	6	14.5	
JUTHLANDIA	ELXV	18	54.3 N	169.0 W	00	25	40	5 NM	51	1013.5	10.0	2.9	5	6.5	25	6	16.5	
ORIENTAL SOVEREIGN	A8UN	18	54.0 N	160.3 W	00	24	M 35	10 NM	03	1014.9	14.0	11.0	10	19.5	24	10	19.5	
SURVEYOR	WTES	18	56.4 N	162.0 W	00	24	M 38	5 NM	02	1002.8	7.8	7.8	3	6.5	27	7	18	
ARCO JUNEAU	KSRG	18	51.1 N	131.0 W	00	32	38	5 NM	05	1012.2	15.0	10.0	4	5	30	6	14.5	
DELAWARE GETTY	KCBC	18	17.8 N	103.6 W	18	18	40	5 NM	62	1011.1	25.5	30.0	3	6.5	18	7	11.5	
MARINER	SLEF	18	42.7 N	154.7 E	19	09	48	10 NM	02	1015.8	18.0	19.0	8	14.5	09	8	14.5	
MARINER	SLEF	19	44.0 N	150.0 E	13	09	40	5 NM	02	1018.0	16.0	12.8	8	19.5	14	9	16.5	
HONG KONG DELEGATE	6ZEW	20	44.5 N	178.5 W	00	08	M 37	.5 NM	44	1015.0	14.2	15.8	8	3	09	7	8	
MARINER	SLEF	20	45.7 N	163.9 E	01	09	40	10 NM	02	1019.0	18.0	14.8	8	13	15	9	16.5	
UNITED SPIRIT	SMKM	20	41.9 N	177.1 E	18	34	M 38	1 NM	50	0999.8	16.5	18.8	6	11.5	34	7	13	
SEATRAIN INDEPENDENCE	D5WL	20	47.6 N	179.0 W	20	09	40	2 NM	61	1011.0	10.0	10.0	6	11.5				
SEATRAIN INDEPENDENCE	D5WL	21	47.5 N	179.1 E	00	09	40	2 NM	03	1012.0	10.0	10.0	6	11.5				
UNITED SPIRIT	SMKM	21	41.6 N	174.6 E	00	35	M 40	1 NM	02	1010.5	18.5	17.0	7	11.5	34	8	13	
PRESIDENT CLEVELAND	KGXA	21	49.2 N	179.8 W	00	04	38	10 NM	02	1013.5	13.9	12.7		11.5				

Vessel	Nationality	Date	Position of Ship		Time GMT	Wind		Visibility n. mi.	Present Weather code	Pressure mb.	Temperature °C		Sea Waves†		Swell Waves		
			Lat. deg.	Long. deg.		Dir. 10°	Speed kt.				Air	Sea	Period sec.	Height ft.	Dir. 10°	Period sec.	Height ft.
NORTH PACIFIC OCEAN		AUG.															
SARGODHA	OUIU	21	50.1 N	169.7 W	00	06	35	2 NM	62	1010.0	10.6	12.0	4	10			
PRESIDENT TYLER	WEZM	21	44.5 N	179.8 W	06	02	M 42	.5 NM	02	0999.1	11.3	13.3	10	23			
MARINER	5LEF	21	47.5 N	177.1 E	18	05	45	2 NM	02	1014.5	11.0	10.0	8	14.5	09	9	14.5
CHEVRON ARIZONA	KGBE	21	42.1 N	124.9 W	18	36	M 40	10 NM	02	1015.6	10.0		7	10	36	7	13
PRESIDENT CLEVELAND	KGXA	22	48.8 N	173.1 W	00	04	35	2 NM	02	1001.0	15.6	8.9	5	11.5			
NEPTUNE AMBER	S6CY	22	52.7 N	143.1 W	00	19	M 35	5 NM	00	1015.4	14.1	12.0	4	6.5	14	8	8
HONSHU GLORIA	A8PJ	22	51.9 N	166.7 W	06	08	M 35	2 NM	63	1011.0	12.0	12.0	5	19.5			
ORIENTAL TAIO	A8CV	22	52.5 N	140.8 W	06	26	M 45	5 NM	03	1006.0	13.0	16.0	6	13	26	< 6	13
MARINER	5LEF	22	47.3 N	177.1 W	18	04	45	1 NM	00	1015.5	10.0	10.0	9	16.5	08	9	16.5
MARINER	5LEF	23	47.2 N	176.2 W	00	04	45	1 NM	00	1015.5	10.0	9.0	9	16.5	07	9	16.5
OVERSEAS NEW YORK	WMCK	23	43.3 N	128.8 W	00	34	40	5 NM	01	1020.0	17.7	15.0	3	5	34	< 6	16.5
SEATRAIN INDEPENDENCE	D5KL	24	39.2 N	148.5 E	00	22	35	200 YD	81	1015.5	24.0	22.0	4	5	XX		8
MARINER	5LEF	24	48.0 N	167.0 W	05	04	40	5 NM	03	1021.5	19.0	10.0	8	14.5	07	8	14.5
TRIUMPH	3EZZ	24	40.5 N	152.1 E	18	09	M 35	5 NM	03	1004.0	18.0	22.0	10	16.5	08	10	16.5
PRINCE WILLIAM SOUND	WSPX	24	56.0 N	141.7 W	18	12	M 35	2 NM	21	1016.5	11.7	13.9	3	6.5			
MARCONA EXPORTER	ELEC	24	33.7 N	143.9 E	18	24	50	.25 NM	82	1006.8	25.0	28.0	6	10	26	< 6	8
PERENNIAL ACE	HOMQ	25	48.9 N	177.0 W	00	10	M 37	.25 NM	63	1006.0	11.0	8.0	7	11.5	07	10	11.5
OCEAN BRIDGE	7LYR	25	39.7 N	158.5 E	00	14	M 38	2 NM	05	1007.7	18.5	21.0	8	6.5	24	< 6	5
PRESIDENT PIERCE	WURV	25	50.0 N	177.7 E	06	04	35	1 NM	81	1001.5	10.0	9.4	3	10	07	6	16.5
GOLDEN GATE BRIDGE	JPZD	25	46.4 N	169.9 W	06	15	M 35	.25 NM	55	1009.5	15.5	13.0	4	8	20	7	10
TRIUMPH	3EZZ	25	41.9 N	154.3 E	12	06	M 44	5 NM	03	1010.0	15.0	16.0	8	16.5	06	8	16.5
NEW CADMUS	5MHI	25	54.1 N	177.4 W	18	07	M 37	.5 NM	63	1008.2	10.2	9.0	9	13			
WASHINGTON WOOD	JEOV	25	43.1 N	146.7 E	18	05	M 35	5 NM	01	1016.0	11.5	12.5	6	10	05	6	10
WASHINGTON WOOD	JEOV	26	43.5 N	147.5 E	00	05	M 35	5 NM	01	1018.5	14.0	14.4	6	8	05	6	8
TRIUMPH	3EZZ	26	42.8 N	157.2 E	00	06	M 35	5 NM	02	1014.0	14.0	13.0	7	13	06	6	13
PRESIDENT TYLER	WEZM	26	34.9 N	141.0 E	00	13	M 12	10 NM	02	1012.2	25.6	24.4	5	24.5			
SAN DIEGO	WSVR	26	52.4 N	136.6 W	12	34	M 35	10 NM	02	1015.6	12.6	13.3	5	6.5			
PACIFIC ENTERPRISE	WGJA	26	49.0 N	166.7 E	16	33	40	10 NM	02	1003.7	10.0	11.1	6	16.5	36	7	11.5
ORIENTAL COMMANDER	6ZWU	26	40.0 N	151.3 E	18	08	M 36	5 NM	81	1014.0	20.0	21.5	6	10	05	8	13
SAMUEL S	5LHX	27	25.1 N	128.5 E	00	14	M 38	5 NM	02	1003.5	31.0	32.0	5	5	14	7	8
PACIFIC ENTERPRISE	WGJA	27	49.3 N	168.1 E	00	33	40	10 NM	02	1004.4	11.7	11.1	6	16.5	36	9	16.5
PACDUCHESS	A8VI	27	39.9 N	150.2 E	00	09	M 35	5 NM	02	1016.0	20.0	21.0	5	11.5	09	< 6	11.5
MALLORY LYKES	KLPN	29	13.1 N	134.2 E	00	08	35	1 NM	61	1013.7	23.3	26.9	3	2	05	< 6	5
PERENNIAL ACE	HOMQ	29	49.7 N	133.4 W	03	17	M 37	2 NM	60	1013.5	15.0	14.5	4	6.5	16	6	6.5
POLAR ALASKA	5LEU	31	36.4 N	146.2 E	00	09	M 40	2 NM	60	1011.0	23.0	20.0	5	5			
SEALAND COMMERCE	WEUJ	31	40.6 N	151.5 E	18	10	35	2 NM	61	1006.5	14.2	18.3	8	6.5	10	9	11.5
PRESIDENT ADAMS	KAAV	31	39.6 N	151.4 E	18	14	37	5 NM	18	1004.6	20.6	20.6	5	11.5	12	>13	16.5

+ Direction for sea waves same as wind direction
X Direction or period of waves indeterminate
M Measured wind

NOTE: The observations are selected from those with winds ≥ 35 kn or waves ≥ 35 ft from May through August (≥ 41 kn or ≥ 33 ft, September through April). In cases where a ship reported more than one observation a day with such values, the one with the highest windspeed was selected.

U.S. Cooperative Ship Weather Reports

July and August 1980

This listing includes only those ships recruited in the U.S. Cooperative Ship Program whose Ship's Weather Observations (NOAA Form 72-1) were mailed to the National Climatic Center and/or the coded weather observations were transmitted to the appropriate radio station.

SHIP NAME	VIA RADIO	VIA MAIL
ACADIA	13	1
ACUSHNET WABO 167	1	148
ADRIATIC	20	
AIMEE LYKES	28	67
ALBERT MAERSK	17	61
ALLISON LYKES	11	63
ALSTER EXPRESS	83	77
AMERICA SUN	55	155
AMERICAN APOLLO	26	131
AMERICAN ARROW	5	
AMERICAN CHARGER	26	104
AMERICAN HIGHWAY	25	
AMERICAN LEADER	54	125
AMERICAN LIBERTY	6	89
AMERICAN RELIANCE	11	51
ANCHORAGE	11	
ANDERS MAERSK	27	69
ANTONIA JOHNSON	10	44
ARCO CALIFORNIA	8	14
ARCO JUNEAU	41	61
ARECIBO	30	77
ARNOLD MAERSK	15	48
ASIA BEAUTY	8	
ASIA HONESTY	1	
ATHEL LAADHI	14	
AUSTRAL ENSIGN	13	111
AUSTRAL GLEN		95
AUSTRAL PILOT	11	79
AXEL MAERSK	12	68
BAKAR	5	
BARBER TAIF	9	16
BARWA	8	80
BAYANO	60	
BERNES	5	
BLUE BOTTLE	35	86
BOGASARI SATU	13	27
BOUTWELL WHEC 719	63	96
BRITANIS	11	
BUTTONWOOD WLB 306	19	
CAGUAS		61
CARNIVALE	2	
CHANCELLORSVILLE	7	52
CHARLESTON	11	51
CHAVEZ	8	3
CHESHIRE	37	44
CHEVRON BURNABY	22	16
CHEVRON FELUY	6	24
CHEVRON LOUISIANA	47	134
CHEVRON OREGON	2	
CHILBAR	1	
COLORADO	26	67
COMET	45	65
CORAL ARCADIA	1	
COURAGEOUS WHEC 622	47	59
CRYSTAL REED	30	21
DAFFODIL	4	100
DANA ARABIA	6	
DAVID O. IRWIN	17	19
DE STEIGUER T-AGOR12	28	
DEL RIO	9	3
DELAWARE SUN	52	34
DELTA BRASIL	7	
DELTA MAR	8	120
DELTA URUGUAY	18	16
DISCOVERER OSS	111	191
DOCTOR LYKES	40	132
DRUCILLA U	22	
E. HORNSBY WASSON	22	166
EASTERN FORTUNE		27
EASTERN TREASURE	60	138
EDGAR M QUEENY	20	28
ENNA G	34	62
ESSO CASTELLON	1	
ESSO PROVIDENCE	31	49
EVER SPRING	42	28
EXPORT AMBASSADOR	12	46
EXPORT CHAMPION	5	43
EXPORT PATRIOT	26	29
EXXON BOSTON	17	31
EXXON HOUSTON	13	27
EXXON NEW ORLEANS	40	58
EXXON SAN FRANCISCO	10	120
FALSTRIA	40	76
FLORA ISLAND	3	
GAGE LUND	71	
GENEVIEVE LYKES	23	85
GLACIER BAY	36	65
GOLDEN DAISY	21	
GOLDEN RAY	10	
GRAND CARRIER	1	
GREEN AUKLET	47	
GREEN KOBE	15	134
GULF SHIPPER	32	91
H J HAYNES		18
HANJIN SEOUL	5	
HAWAIIAN CITIZEN	99	180
HOEGH HALLARD	5	22
HOEGH MERIT	10	96
HOEGH PRIDE	11	61
HOWARD G VESPER		9
IMPERIAL	14	9
IRIS QUEEN	83	
IVAN TOPIC	1	
JACKSONVILLE	20	94
JAMES E O'BRIEN	1	
JAPAN APOLLO	39	60
JOHN LYKES	37	
KATHLEEN	24	53
KNORR	56	66
KOREAN COMMANDER	8	26
KURORE MARU	49	31
LAKE ARROWHEAD	3	37
LAKE TAHOE		90
LEO	20	34
LILLOGET	16	79
LOUISE	49	103
LURLINE	46	161
MALLORY LYKES	2	101
MANISTEE	21	
MANULEI	58	100
MARCONA TRANSPORTER	27	105
MARGRETHE MAERSK	4	
MARINE CHEMICAL TRANSP	21	111
MASON LYKES	24	127
ACE ENTERPRISE	12	106
ADABELLE LYKES	17	
AFRICAN DAWN	8	98
ALASKA STANDARD	32	21
ALERT	5	
ALLTRANS ENTERPRISE	1	
ALVA MAERSK	35	131
AMERICAN ACCORD	13	125
AMERICAN AQUARIUS	31	130
AMERICAN ASTRONAUT	46	79
AMERICAN CHIEFTAIN	45	67
AMERICAN INDEPENDENCE	9	91
AMERICAN LEGACY	46	74
AMERICAN LYNX	21	157
AMERICAN TRADER	55	243
ANCO STANE	95	
ANNA MAERSK	26	35
AQUARIUS WLR386	20	101
ARCO ENTERPRISE	3	12
ARCO PRESTIGE	36	86
ARGONAUT	15	
ARTHUR MAERSK	15	84
ASIA BOTAN		64
ASIA INDUSTRY	8	
ATLANTIC PIONEER	6	
AUSTRAL ENTENTE	22	
AUSTRAL LIGHTNING	57	129
AUSTRAL PIONEER	12	19
AZTECA	2	11
BALD BUTTE	8	126
BARBER TOBA	23	28
BASSWOOD WLR386	17	25
BEISHU MARU	61	43
BERTHA BROVIG	1	
BLUE OCEAN	9	142
BOHEME	15	112
BRAZOS	54	152
BROOKS RANGE	17	31
C V LIGHTNING	13	57
CALIFORNIA RAINBOW	13	20
CASUARINA	17	
CHAPMAN	3	
CHARLOTTE LYKES	14	
CHEMICAL VENTURE	14	
CHESNUT HILL	21	28
CHEVRON CALIFORNIA	62	113
CHEVRON FRANKFURT	11	160
CHEVRON MISSISSIPPI	58	85
CHEVRON PERNIS	34	180
CHRISTOPHER LYKES	19	69
COLUMBUS AMERICA	38	
CONCORDIA STAR	22	
CORNELIA MAERSK	3	
COVADONGA	21	91
CRYSTAL STAR	28	57
DALAMAR	29	44
DANWOOD ICE	15	87
DAVID P REYNOLDS	67	156
DECISIVE WMEC-629	1	72
DEL SOL	17	18
DELTA AFRICA	14	99
DELTA CARIBE	7	101
DELTA MEXICO	31	64
DELTA VENEZUELA	23	41
DITTE SKOU	16	93
DOLLY TURMAN	9	20
DUBHE	18	
EAGLE	64	
EASTERN MUSE	41	
EASTERN WHITEMAN	20	12
EL PASO HOWARD BOYD	7	
ERNA OLDENDORFF	14	
ESSO CORAL GABLES	1	
ESSO SAINT JOHN	21	49
EVER VALUE	19	64
EXPORT BANNER	12	57
EXPORT COMMERCE	6	14
EXXON BALTIMORE	39	71
EXXON CHESTER	11	14
EXXON HUNTINGTON	20	93
EXXON NEWARK	17	16
EXXON WASHINGTON	21	37
FESTIVALE	22	
FRANCIS SINCERE NO 6	17	
GALLEON OPAL	1	
GENISTA	4	55
GLADIOLUS	8	
GOLDEN GATE	17	37
GOLDEN HIND	43	
GRAND GLOBE	15	17
GREEN FOREVER	94	44
GREEN VALLEY	6	
GULF TRADER	20	84
HAMILTON WHEC 715		35
HARDANGER		11
HELLESPONT GLORY	15	35
HOEGH MARLIN	7	
HOEGH MIRANDA	17	61
HONSHU BREEZE	25	62
HOWARD W BELL	9	31
INACHUS STAR	24	77
IRONWOOD WLB 297	11	
J E GOSLINE	6	18
JADRANKA	5	
JAMES LYKES		6
JAPAN CADDO	10	48
JOSEPH LYKES	24	
KEIYO	11	78
KOFUKU MARU	20	96
KOREAN FIR	15	9
L.L. FUNKHOUSER	5	18
LAKE BERRYESSA	7	
LASH ATLANTICO	23	62
LESLIE LYKES	39	121
LIONS GATE BRIDGE	99	98
LOUISE LYKES	6	29
LUTZ SCHROEDER	31	
MAMMOTH FIR	48	77
MANUANUI	68	119
MANZANARES	1	
MARDI GRAS	45	32
MARIA TOPIC	16	
MARITIME DOMINION	22	
MATHIESON	44	71
ACHILLES	1	
ADM WM M CALLAGHAN	30	89
AGUADILLA	78	189
ALASKAN	32	52
ALEUTIAN DEVELOPER	32	95
ALLTRANS EXPRESS	29	98
AMELIA TOPIC	19	32
AMERICAN ACE	41	119
AMERICAN ARCHER	97	182
AMERICAN CHALLENGER	7	81
AMERICAN CORSAIR	35	105
AMERICAN LANCER	62	121
AMERICAN LEGEND	31	69
AMERICAN RACER	30	105
AMERICANA	26	46
ANCO TEMPLAR	88	
ANNIE JOHNSON	8	33
ARCO ALASKA	31	117
ARCO FAIRBANKS	48	86
ARCO PRUDHOE BAY	67	116
ARIES	26	43
ARTHUR MIDDLETON	2	
ASIA BRAVERY	13	164
ASIAN ASSURANCE	1	83
ATLANTIC RAINBOW	25	161
AUSTRAL ENVOY	26	51
AUSTRAL MOON	35	151
AUSTRAL RAINBOW	67	115
B T ALASKA		117
BALTIMORE TRADER	10	
BARBER TONSBERG	24	36
BAY	21	12
BEL HUDSON	2	
BIBB WHEC 31		13
BLUEBIRD	62	34
BORINQUEN	101	93
BRIGHT HOPE	40	58
BUILDER	1	14
C V STAGHOUND	24	98
CAMPBELL WHEC 32	6	
CELESTINO	3	
CHARLES LYKES	38	103
CHASE WHEC 718	21	
CHEROKEE WMEC 165	1	26
CHEVRON ARIZONA	50	76
CHEVRON COLORADO	77	90
CHEVRON KENTUCKY	94	
CHEVRON NAGASAKI		119
CHEVRON PERTH	21	39
CITRUS WLB380	47	
COLUMBUS LOUISIANA	13	
CONNECTICUT	7	
CORNUCOPIA	39	75
CRESSIDA	32	102
CUNARD AMBASSADOR	2	
DALLAS WHEC 716	1	
DART EUROPE	53	48
DAVID STARR JORDAN	48	37
DEFIANCE	31	
DELAWARE GETTY	51	91
DELTA AMERICA	19	71
DELTA COLUMBIA	17	
DELTA PARAGUAY	37	65
DIAMOND PHOENIX	31	131
DJATISARI	33	
DONA MARGALENA		80
EDYTI KATTERAT	1	8
EASTERN CHERRY	53	173
EASTERN PACIFIC		27
EASTERN WORLD	29	19
ELIZABETH LYKES	9	42
ERRADALE	1	
ESSO PALM BEACH	21	18
EUGENIO C.	19	
EVERGREEN WABO-295	9	9
EXPORT BUYER	9	3
EXPORT FREEDOM	12	44
EXXON BANGOR	12	52
EXXON FLORENCE	9	24
EXXON JAMESTOWN	32	40
EXXON NORTH SLOPE		38
FAIRWEATHER	6	8
FFM HATARENGI	1	
FREDERICK LYKES	11	
GARDENIA	30	43
GEORGE B KELEZ	19	
GLOBAL FRONTIER	5	52
GOLDEN GATE BRIDGE	107	77
GOLDENSARI II	23	69
GREAT LAND	48	92
GREEN HARBOUR	9	
GULF BANKER	13	
GULFCREST	1	
HANJIN INCHEON	4	27
HARNGJIN	7	
HIEI MARU	129	84
HOEGH MASCOT	3	59
HOEGH OPAL	1	
HONSHU GLORIA	39	133
HOWELL LYKES	32	81
INGER	4	113
ITALICA	40	51
J LOUIS	66	129
JALAMINI	15	
JAPAN ACE	84	50
JEAN LYKES	1	51
JUTHLANDIA	16	114
KENNETH E HILL	14	65
KOPAA	99	164
KOREAN LEADER	1	
LABRADOR CLIPPER	48	
LAKE PALOURDE	4	
LASH ITALIA	4	17
LETITIA LYKES	31	85
LONG BEACH	2	
LUCINA	1	
MAGDALENA	51	
MANHATTAN	23	
MANUKAI	74	129
MARCONA CONVEYOR	38	119
MARGARET JOHNSON	36	32
MARIA G	1	
MARITIME HARMONY	13	12
MATSONIA	73	113
ACONCAGUA	13	27
ADRIAN MAERSK	33	99
AIDA	7	72
ALBATROSS IV	42	
ALBENIB	58	78
ALMERIA LYKES	23	136
AMERICA MARU	101	40
AMERICAN ALLIANCE	24	92
AMERICAN ARGOSY	29	94
AMERICAN CHAMPION	12	61
AMERICAN COURIER	7	29
AMERICAN LARK	48	142
AMERICAN LEGION	26	125
AMERICAN RANGER	27	72
AMOCO MILFORD HAVEN	5	43
ANDALUSIA	16	
ANTE TOPIC	11	28
ARCO ANCHORAGE	81	90
ARCO HERITAGE	27	69
ARCO SAG RIVER	8	27
ARILO MAERSK	25	89
ASHLEY LYKES	6	20
ASIA HERON	3	
ASIAN EXPRESS	5	
AUSTRAL ENDURANCE	6	32
AUSTRAL GLADE	31	77
AUSTRAL PATRIOT		18
AVILA	14	28
B T SAN DIEGO	18	195
BARBER PRIAM	47	
BARRANCA	45	
BAYAMON		72
BELLMAN	83	92
BLESS RIVER	31	84
BOGASARI DUA	6	
BOSTON	13	15
BRINTON LYKES	15	36
BUNGA MELAWIS	35	138
C.W. HITTO		24
CAPRICORN	37	63
CHALMETTE	11	61
CHARLES PIGOTT	11	146
CHAUVENET T AGS 29		169
CHERRY VALLEY	13	67
CHEVRON BRUSSELS		44
CHEVRON EDINBURGH	2	116
CHEVRON LONDON		30
CHEVRON NORTH AMERICA		229
CHEVRON SOUTH AMERICA	11	53
CK APOLLO	1	
COLUMBUS NEW ZEALAND	24	45
CONTRACT TRADER	1	
CORVIGLIA	4	
CRISTOBAL	16	27
DA MOSTO	3	
DANA AMERICA		3
DAUNTLESS CG	38	
DAVIDSON	4	8
DEL ORO	19	69
DELAWARE II	75	92
DELTA ARGENTINA	24	111
DELTA ECUADOR	35	87
DELTA SUD	12	68
DIANA	30	53
DOCEANGRA	15	13
DORIC	29	44
EDYI PACIFIC	13	24
EASTERN DIAMOND	2	89
EASTERN RIVER	4	
ECLIPSE	4	8
EMPIRE STATE	1	2
ESSO BAYONNE	36	86
ESSO PHILIPPINES	13	37
EURO-ASIA CONCORDE	29	77
EXFORD	1	
EXPORT CHALLENGER	15	43
EXPORT LEADER	24	106
EXXON BATON ROUGE	32	71
EXXON GETTYSBURG	2	3
EXXON LEXINGTON	13	66
EXXON PHILADELPHIA	24	53
FAIRWIND	2	
FIREBUSH WLB 393	28	1
FRIENDSHIP	29	124
GARTHNEWYDD	38	67
GEORGE M KELLER	4	135
GLOMAR CHALLENGER	78	195
GOLDEN ORCHID	3	4
GRACE	2	
GREAT OCEAN	17	41
GREEN ISLAND	12	93
GULF MERCHANT	18	68
GULFQUEEN	1	
HANJIN ROHANG		84
HARUNA MARU	125	102
HILLYER BROWN	8	25
HOEGH MERCHANT	7	97
HOEGH PILOT	3	24
HOTAKA MARU	67	19
HUDSON T-AG 184	22	66
IRIS ISLAND	23	105
ITAPUCA	2	
J Y HIGGINS		57
JAMAICA MARU	34	13
JAPAN AMBROSE	29	13
JELA TOPIC	37	81
KASHU MARU	64	42
KEYSTONE	20	133
KOREA GALAXY	1	
KOREAN PRIDE	13	22
LAKE ALMANOR	4	
LAKE LAGUNITA	4	47
LASH PACIFICO	8	48
LEXA MAERSK	34	
LORD NIAGARA	33	
LUIGI GRIMALDI	20	
MAIPO	5	11
MANICA	13	
MANULANI	40	120
MARCONA EXPORTER	17	161
MARGARET LYKES	8	87
MARIAS TAO-97	1	
MARJORIE LYKES	13	49
MAUI	65	132

TOTAL WEATHER REPORTS RECEIVED FROM US COOPERATIVE OBSERVING SHIPS JULY AND AUGUST 1980

SHIP NAME	VIA RADIO	VIA MAIL
MAUMEE	17	86
MAYAYAN REEFER		9
MENESTHEUS	20	43
MINE	1	
MINERVA	1	
MOBIL AERO	10	29
MOBIL VIGILANT	1	
MONMOUTH	13	41
MORMACALTAIR	9	74
MORMACLYNX	11	37
MORMACSKY	22	20
MORMACWAVE	4	95
MUNRO WMEC 724	63	66
NEGO ENTERPRISE	1	
NEW JERSEY MARU	33	42
NEWCASTLE CLIPPER	35	
NORDHVAL	2	
NORTH STAR III	20	43
NURA OEL MAR	9	19
OCEAN HOPE	1	
OCTA	15	68
OGDEN WABASH	1	6
OLGA MAERSK		28
ORCO MINER	6	
ORE METEOR	2	
ORIENTAL CHAMPION	46	56
ORIENTAL EXPORTER	68	61
ORIENTAL QUEEN	14	
OTTO N. MILLER	12	
OVERSEAS JUNEAU	30	
OVERSEAS VIVIAN	2	
PACDUCHESS	14	7
PACIFIC ACE	7	44
PACIFIC SAGA	43	97
PACLADY	7	7
PACNOBLE	14	24
PAN ASIA	2	66
PAUL L FAHRNEY		55
PERENNIAL ACE	79	359
PHILIPPINE ANTONIO LUN	3	40
PINK SKY	24	104
PIONEER CRUSADER	13	32
POLAR STAR WAGB-10	20	57
PRESIDENT FILLMORE	16	127
PRESIDENT JACKSON	22	52
PRESIDENT MADISON	40	62
PRESIDENT TAFT	40	119
PRESIDENT VAN BUREN	65	122
PROSPERITY	8	
QUINTINA	22	
RALPH B JOHNSON	1	12
RESOLUTE WPC 620	49	58
RIO ARAUCAN	23	38
ROBERTSBANK		9
RUTH LYKES	24	78
SAM HOUSTON	19	
SAN FRANCISCO	44	118
SANKOSUN	4	
SANTA MAGDALENA	17	85
SANTO AMARO	16	
SEALAND ADVENTURER	35	70
SEALAND ECONOMY	52	108
SEALAND INDEPENDENCE	22	51
SEALAND PIONEER	16	76
SEALAND VENTURE	27	107
SEATRAIN ORISKANY	43	171
SEAWAY	6	
SEKI MORANO	4	6
SHELDON LYKES	3	
SHUNWIND	49	115
SIMBA	10	69
SKAUGRAN	59	133
SNOWFLOWER		22
SOHIO INTREPID	23	142
SOUTHWEST CAPE	31	
STAR DIEPPE	47	
STATE OF MAINE	37	61
STORIS WAGB 38	13	
SUCCESSFUL VENTURE	5	
SVENDORG MAERSK	15	10
TAI HSIUNG	33	
TAMAROA WMEC-166		39
TENA STAR	8	
TEXACO GEORGIA	35	68
TEXACO NEW YORK	1	
TEXAS TRADER	27	87
THOMAS MAERSK	10	
TILLIE LYKES	43	115
TONAMI MARU	87	30
TOWNSEND CROMWELL	133	173
TOYOTA MARU 1	53	45
TREIN MAERSK	19	40
TWIN JOY	4	
UNION GREEN	1	
UNIVERSE	9	33
VALOR	1	
VAN WARRIOR	52	149
VIOLET	16	
WALTER RICE	30	113
WESTERN SUN		73
WILMINGTON GETTY	42	81
YAMASHIN MARU	97	88
ZIM MONTREAL	40	124
ABIJ		118
DHMC	84	127
DZGS	16	61
D5QC	50	66
D5XA	5	9
ELFY		68
ELKT	64	152
HEQR		43
HBLR	8	54
JCUF	17	31
JMZR	2	2
KFGT		38
KHRP	27	127
KSFK	11	21
LIWP	20	16
NEMY	6	26
NNBN		480
S6AD	25	154
UXIC		1
WJVG		68
WYG5906		22
YVBR		17
3FEQ	8	7
5MMP	4	10
6MUE	13	137
6ZDD	38	90
8KXF	97	66
9VPV	13	166
MAURICIO DE OLIVEIRA	12	25
MAYO LYKES	8	
MEONIA	55	135
MILENA	6	
MING AUTUMN	8	
MOBIL ARCTIC	60	160
MOBILE MERIDIAN	36	83
MONTERREY	2	
MORMACARGO	8	50
MORMACRIGEL	21	50
MORMACSTAR	30	92
MORNING GLORY	25	79
NAGARA	27	33
NEPTUNE CRYSTAL	52	102
NEW JERSEY SUN	1	11
NISSHO NO 1	1	
NORDIC LOUISIANA	71	
NORTHERN LIGHT	15	22
OCEAN CROWN	6	8
OCEAN LOG	22	32
OGDEN CONGO		51
OGDEN WILLAMETTE	15	39
OLGA TOPIC	10	179
ORCO TRADER	9	
ORE SATURN	8	28
ORIENTAL COMMANDER	14	60
ORIENTAL IMPORTER	1	
ORIENTAL SOVEREIGN	17	17
OVERSEAS ALEUTIAN	9	37
OVERSEAS NATALIE		5
OXFORDSHIRE	1	
PACDUKE	7	21
PACIFIC ARROW	115	81
PACIFIC TRADER	95	
PACMAJESTY	7	8
PACPRINCESS	22	8
PAN PACIFIC	16	44
PENNMAR	14	
PERRYVILLE	10	
PHILIPPINE CORREGIDOR	12	68
PIONEER COMMANDER	7	86
PIONEER MOON	83	104
PORTLAND	67	100
PRESIDENT GRANT	37	103
PRESIDENT JEFFERSON	52	74
PRESIDENT MC KINLEY	45	98
PRESIDENT TAYLOR	13	29
PRESIDENT WILSON	38	122
PUERTO RICO	1	
R G FOLLIS	4	31
RELIANCE WMEC 615		80
REVERE	92	116
RIO JUBONES	3	
RODRIGUES CABRILHO	43	
S P LEE	20	
SAM RATULANGIE	21	
SAN MARCOS	20	36
SANSINENA II	30	92
SANTA MARIA	15	12
SARGODHA	24	38
SEALAND COMMERCE	61	142
SEALAND EXCHANGE	81	148
SEALAND LEADER	34	78
SEALAND PRODUCER	23	101
SEASPEED ASTA	4	
SEATRAIN PRINCETON		21
SEAWAY DISPATCH	28	95
SERAFIN TOPIC	9	
SHERMAN WMEC 720	7	18
SIENA	13	
SINALOA	37	130
SKYWARD	13	17
SNOWLAND	9	25
SOLON TURMAN	8	36
SPERO	18	
STAR DOVER	19	103
STELLA LYKES	28	
STOVE TRADER	1	22
SUGAR ISLANDER	46	135
SWEETBRIER WLB 405	5	
TAI TUNG	10	28
TAMPA	11	20
TENNESSEE	17	29
TEXACO MASSACHUSETTS		15
TEXAS	8	
TFL DEMOCRACY	21	116
THOMAS NELSON	22	69
TOBIAS MAERSK	16	31
TONCI TOPIC	5	37
TOYOTA MARU 10	48	26
TOYOTA NO 24	9	
TRIUMPH	32	112
TYSON LYKES	65	120
UNION PROGRESS		38
UNIVERSE AURE	20	153
VAN CONQUEROR	45	99
VELPA LYKES	37	49
VIRGINIA KEY	5	9
WASHINGTON WOOD	4	111
WESTWARD VENTURE	86	112
WINTER STAR	18	21
YOCONA WMEC 168	15	
ZOELLA LYKES	54	129
ABRD		56
DUXX		16
D5EF	30	28
D5VT	3	15
D7OJ	12	35
ELIJ	7	15
GVDE	101	147
HDMV	1	60
HBTA	6	48
JMJB	1	19
JQGA	6	9
KGJD	47	110
KNCX	7	29
KSLB	13	75
LRQB	7	15
NHDS	42	51
NQSI		47
S6CY	32	80
WCOY		3
WPEV		68
WYS3261		44
3EBP	6	16
3FWS		48
5MOJ	1	9
5MYK	12	26
6ZLM	34	50
9MTR	22	51
9VVT	42	129
MAYA PIONEER		74
MEADOWBROOK	17	64
MERCY	35	22
MILLER FREEMAN	139	172
MING CHEER	8	
MOBIL LUBE	6	25
MOBILFUEL	49	124
MONTPELIER VICTORY	26	93
MORMACDRACO	24	78
MORMACSAGA	18	52
MORMACSUN	79	124
MOZART FESTIVAL	36	
NANCY LYKES	49	
NEPTUNE RUBY	7	
NEW YORK MARU	24	45
NORAWAY	15	52
NORDIC PRINCE	2	
NORTHWIND WAGB 282	81	310
OCEAN DUKE	4	
OCEANIC		168
OGDEN FRASER	55	58
OJI GLORIA	26	
OLIVIA MAERSK	1	
ORE JUPITER	19	
ORE TRANSPORT	1	
ORIENTAL ESEARCHER	9	10
ORIENTAL LEADER	8	32
ORIENTAL STATESMAN	12	73
OVERSEAS ARCTIC	15	68
OVERSEAS NEW YORK	23	62
PACBARON	35	41
PACEMPEROR	13	
PACIFIC ERA	68	151
PACIFIC VENTURE	72	169
PACMERCHANT	19	
PACPRINCESS	24	44
PAN WESTERN	17	17
PENNSYLVANIA SUN	7	10
PERSIAN REEFER	19	34
PHILLIPS NEW YORK	2	
PIONEER CONTENDER	14	63
POLAR ALASKA		50
PRESIDENT ADAMS	38	83
PRESIDENT HARRISON	18	25
PRESIDENT JOHNSON	74	177
PRESIDENT PIERCE	58	146
PRESIDENT TRUMAN	42	124
PRINCE OF TOKYO	29	60
PURE OIL	7	72
RADIANT STAR	8	9
RESEARCHER	49	100
RHEINFELS	17	
RIO MACAREO	1	
ROSE		36
SACRAMENTO	2	44
SAMOA	33	
SANKOSTAR	19	
SANTA BARBARA	27	27
SANTA MARIANA	15	69
SCILLA	63	87
SEALAND CONSUMER	46	92
SEALAND FINANCE	45	101
SEALAND MARKET	35	81
SEALAND RESOURCE	19	62
SEATRAIN INDEPENDENCE	57	90
SEATRAIN TRENTON	72	153
SEBASTIAN LERDO DE TEJ	1	
SEVEN OCEAN	16	
SHING SM	10	
SILVER PHOENIX	19	64
SINCERE NO 3	16	13
SNOW STORM	6	26
SOBRINO	10	
SONG OF NORWAY	48	48
SPRINGBANK	1	
STAR HONGKONG	27	42
STOLT LLANDAFF	8	78
STREAM HAWSER	16	16
SURVEYOR	75	214
T F L INDEPENDENCE	5	
TAKARA	37	
TASSO	45	65
TERRIER	6	
TEXACO MISSISSIPPI	3	
TEXAS CLIPPER	46	
YFL FREEDOM		67
THOMPSON LYKES	14	43
TOMBEI MARU	41	19
TONSINA	17	109
TOYOTA MARU 12	123	160
TRANSCOLORADO	33	55
TROPICANA	2	
ULTRASEA	24	74
UNITED SEA ANGEL	9	41
UTE ATF 76	10	
VAN FORT	1	
VICENTE GUERRERO	4	
VIRGINIA STAR	37	75
WESTER EXPRESS	34	94
WHITING	31	
WINTER WATER	7	21
YOUNG AMERICA	19	47
ATPG	22	55
BLHV	7	18
DVXL		99
D5EE	10	23
D5VT	22	75
D8TP	12	52
ELPR	15	21
EYZT		14
HPET	31	77
HOCK	5	14
JAMG	43	23
JKKG	15	31
K6JO	27	62
KPAL	13	34
LFEN	14	26
LRUB		17
NJZD		42
SFYX		9
S6CY	115	160
WDZB	12	24
WSNB	31	76
WZF2499		13
XEJX	4	11
3LUB	27	214
5MDS	11	18
6XCJ		79
6ZWT	24	102
9VBM		43
MAYAGUEZ	58	95
MELLOM WMEC 717	29	
MIDGETT WMEC 726	40	63
MILROSS	25	47
MING SPRING	16	
MOBIL POWER	26	69
MOBILOIL	3	12
MORANT	69	
MORMACGLEN	3	48
MORMACSEA	6	
MORMACVEGA	26	63
MT MITCHELL	65	136
NECHES	60	84
NEW GOLDEN PHOENIX	64	115
NEWARK	68	118
NOPAL BRANCO	7	13
NORSE PILOT	19	
NORWAY	25	
OCEAN ENERGY CONVERTER	1	28
OCEANOGRAPHER	21	67
OGDEN TKAMES	28	97
OLEANDER	87	107
ORANGE	42	
ORE MERIDIAN	30	
ORIENTAL ACE	1	
ORIENTAL EXECUTIVE	25	127
ORIENTAL MERCHANT	98	140
ORIENTAL TAIO		153
OVERSEAS CHICAGO	1	2
OVERSEAS VALDEZ		37
PACBARONESS	12	7
PACGLORY	4	22
PACIFIC PEACE	16	87
PACKING	7	
PACMONARCH	5	
PACSTAR	17	13
PARALLA	23	59
PEREIRA D'ECA	35	
PHILADELPHIA	59	106
PHILLIPS TEXAS	4	
PIONEER CONTRACTOR	16	
POLAR SEA	1	
PRESIDENT CLEVELAND	29	98
PRESIDENT HOOVER	69	126
PRESIDENT KENNEDY	52	106
PRESIDENT POLK	48	40
PRESIDENT TYLER	40	135
PRINCE WILLIAM SOUND	22	123
QUEENS WAY BRIDGE	93	55
RAINIER	21	31
RESOLUTE	43	122
RICHARD	34	47
ROBERT E LEE	3	18
RUSH WMEC 723		41
SALVADOR	29	96
SAMUEL S		3
SANKOSTEEL	3	82
SANTA CLARA	7	53
SANTA MERCEDES	37	106
SEA FAN	17	
SEALAND DEVELOPER	30	110
SEALAND GALLOWAY	34	126
SEALAND MCLEAN	49	121
SEALAND TRADE	47	143
SEATRAIN LEXINGTON	52	157
SEATRAIN YORKTOWN	41	166
SEDGE WLB 402	3	
SHANGRI LA	10	81
SHIRLEY LYKES	65	43
SILVER STAR	18	32
SINCERE NO 5	13	
SNOWFLAKE		75
SOCONY VACUUM	13	94
SOUTHWARD	20	11
STADT BREMEN	12	
STARWARD	5	
STONEWALL JACKSON	7	
STUYVESANT	5	15
SUSQUEHANNA	14	152
T F L LIBERTY	4	48
TALUGA T-AO-62	2	98
TAURUS	23	91
TEXACO FLORIDA	10	33
TEXACO MONTANA		6
TEXAS SUN	1	8
THOMAS G THOMPSON	30	143
THOMPSON PASS	21	19
TOKYO RAINBOW	7	45
TOSCA	2	
TOYOTA MARU 83	88	77
TRANSCOLUMBIA	7	26
TUBUL	45	90
UNION FRIENDSHIP	1	
UNITED SPIRIT	24	190
VALLEY FORGE	35	
VAN TRIUMPH	32	74
VIENNA WOODS	34	35
WALCHAND	13	
WESTERN HIGHWAY	45	48
WILLIAM E MUSSMAN	23	144
WORLD CANDOUR	12	78
YOUNG SEAGULL	17	93
ABDP	56	108
CZDS		41
DZED	2	68
D5WZ	4	10
D5WE	13	56
D9CB		105
ELUU	14	17
HBFW	20	42
HBES	52	61
ICXL	2	34
JMVI	67	48
KDAA		177
KHRF	63	142
KSFJ	40	110
LIGN	27	91
NDSY		59
NLGA		34
S0LN	14	14
3AFA	49	144
6GJF	37	99
6YA9674		141
WZLB198		52
XEKO		23
5MMI	28	82
5MSN	9	16
6ZBT	12	64
7LYR	7	18
9VNY	18	27

SUMMARY: GRAND TOTAL VIA RADIO 23624 GRAND TOTAL VIA MAIL 53034

Rough Log, North Atlantic Weather
October and November 1980

ROUGH LOG, OCTOBER 1980--There were nearly the normal number of significant storms this month. The storm paths did not closely follow the climatological pattern. A path from the Great Lakes into the Davis Strait did not exist. The most heavily traveled track was from James Bay to Iceland. There was also a track from off the U.S. East Coast to the central ocean south of Iceland. As the storms approached or were over Europe, they crisscrossed in all directions.

The overall configuration of the Icelandic Low was normal, resembling a boomerang, but the elbow was shifted from the primary 1001-mb center south of the Denmark Strait to a 1004-mb low center over Scandinavia. There were four 1004-mb and one 1003-mb centers. The 1021-mb Azores High was near 29°N, 43°W, about 600 mi southwest of its usual position.

The sea-level pressure departures over water were minor, except over northern waters. There was a plus 10-mb anomaly center over the Denmark Strait, and another over Cornwallis Island on the Northwest Passage. The major negative anomaly was 8 mb over southern Sweden.

The center of circulation in the upper air pattern at 700 mb was shifted from northern Ellesmere Island to south of Hudson Strait. This sharpened and tightened the trough near eastern North America. The flow over water between latitudes 35° and 55°N was zonal and stronger than normal. There were negative height anomalies over eastern Canada and northern Europe.

Hurricane Ivan was the only tropical cyclone this month.

Extratropical Cyclones--A frontal system stalled along the East Coast on the 3d as several waves formed and moved northeastward. On the 0000 chart of the 4th a frontal wave formed and persisted as it moved northeastward. The storm raced northeastward and by 1200 on the 6th was near 66°N, 20°W, at 975 mb. At this time several ships reported winds over gale force. Among them were the MANCHESTER CRUSADE (55°N, 16°W) with 44-kn winds and 23-ft waves and the STEFAN BATORY (54°N, 29°W) with 40-kn winds and 25-ft seas. By 0000 on the 7th the pressure had dropped to 958 mb and the storm was churning the waters east to Greenland and south to Spain (fig. 32). Many ships and platforms were receiving winds up to 50 kn. The ARCTIC TROLL (49°N, 6°W) had 20-ft swell waves. An Icelandic ship near 64°N, 12°W, had 60-kn winds from the north.

The many reports of high winds continued through the day and at 1800 the ANCO EMPRESS (51°N, 07°W) had 41-ft waves and the ATLANTIC PROSPER (48°N, 12°W) had 46-ft waves. On the 8th the storm stalled near 64°N, 05°E, and the pressure was as low as 954 mb. Winds up to 50 kn and waves to 25 ft continued to whip the ocean surrounding the British Isles. On the 9th the storm was weakening and splitting into other centers.

This storm originated about 600 mi east of Long Island on the 6th. It crossed Trinity Bay on the 8th and caused no great disturbance until the 9th, when it started to intensify. At 1200 the pressure was 996 mb. At 1800 a

Figure 32.--The primary storm is centered north of Scotland. Notice a second circulation southwest of the Faeroe Islands.

Soviet ship had 50-kn winds and 23-ft waves slightly north of the center. The SEALNES found 54-kn winds on the 10th. The AMERICAN ARGOSY (51°N, 21°W) and OWS Romeo both fought 20-ft waves. The TERTRE ROUGE on the North Sea had 56-kn winds out of the south. On the 11th two ships south of Lands End had 50-kn winds with one having 30-ft seas. The storm crossed the English Channel and continued southeastward.

The cold, north country west of Churchill, Canada, produced this storm on the 7th. By the 9th the storm was over Quebec Province and quite large. The northerly flow west of the center brought a record cold 22°F to Sault Ste. Marie. A ship on Hudson Bay had 54-kn northerly winds on the 10th. There were several ships with 50-kn winds on the 11th. The WAL-

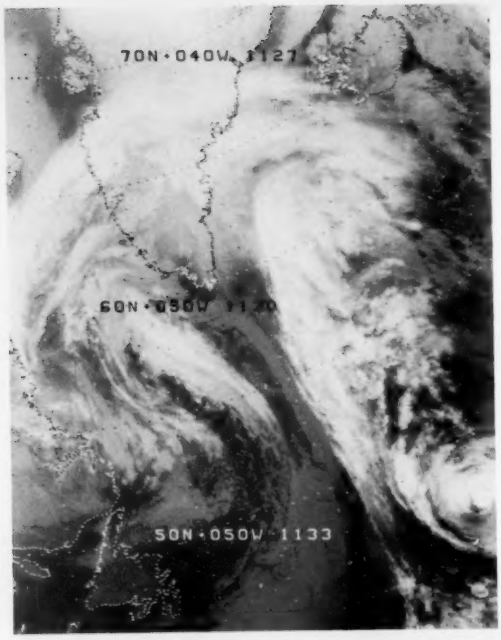


Figure 33.--The extratropical storm is centered over the Labrador Sea with Ivan to the southeast.

THER HERWIG near 61°N, 35°W, had 23-ft waves. Hurricane Ivan was moving northward in the warm sector of the storm (fig. 33). By the 12th he was extratropical, and at 1200 brought 60-kn winds and 31-ft seas to OWS Lima just prior to passing over her position. The waves were still 26 ft at 1800. The two LOWs combined on the 13th, and the ARNI FRIDRIKSSON found winds over 50 kn near 63°N, 18°W, north of the center. Winds in the 40-kn category continued on the 14th with Romeo reporting 25-ft seas.

The storm was moving southward on the 14th, but it turned northeastward on the 15th while over the Bay of Biscay. The TROLL PARK was west of the center with 44-kn winds and 23-ft waves. The storm brought winds over 40 kn to the North Sea on the 17th. The FENGTIEN was on the Bay of Biscay with 44 kn and 26-ft waves. The storm was centered near Oslo on the 18th and many reporters had winds near 50 kn and waves near 25 ft. The BALTIC VALIANT near 55°N, 02°E, found 33-ft waves. On the 19th the winds and waves died down as the storm moved northward into the Barents Sea. The following ships had problems during this storm. The 500-ton Irish ARKLOW BRIDGE was shipping water in heavy seas off Whitby High lighthouse on the 17th and 18th. The SIRIUS encountered heavy weather on the 18th in the North Sea and the cargo shifted. Three Russian ships, the PIONEER BELORUSSII, VASILIY POLENCO, and MITROFAN GREKOV, in the North Sea encountered heavy weather and their cargoes of wood shifted. All took refuge in Norwegian ports on the 19th. The GIANNA A., anchored off Stavanger because of heavy weather, caught an electric cable when weighing anchor. The Greek SKYRIAN HOPE sank off northern Spain after the steel beam cargo shifted in heavy seas on the 20th.

The central ocean produced this storm. It was 997 mb at 1200 on the 18th. The LONDON BARON was 180 mi southwest of the center with 52-kn winds and 13-ft waves. As the storm traveled northward, another LOW from Nova Scotia moved into the southern part of the circulation. They traveled northward as a pair. The higher winds were in the strong gale range with some waves up to 25 ft. The second LOW disappeared on the 20th and this one on the 22d. Prior to that though, the BAMSA DAN at 59°N, 18°W, had 51-kn winds and 30-ft seas out of the east.

This was a very long-lived LOW, which survived the last two weeks of the month. It became very weak at times, but it was still identifiable. The storm formed over the Great Basin in Nevada and traveled to Hudson Bay, where it made a cyclonic loop on the 19th and 20th. As it passed north of the Great Lakes, it deposited rain in that basin. It then traveled to the Maritime Provinces by the 22d as a weak depression.

East of St. John's the storm picked up strength from the warmer water and had a large circulation by the 24th. Some gales were now blowing. The LACKENBY (47°N, 51°W) ran into 45-kn winds and 23-ft swell waves at 0600. By midday on the 25th the storm was 966 mb and stretched from Cape Race to Ireland and Iceland to 35°N (fig. 34). There were 19 reports of winds of 40 kn or greater. Six of them were from ships of Ameri-

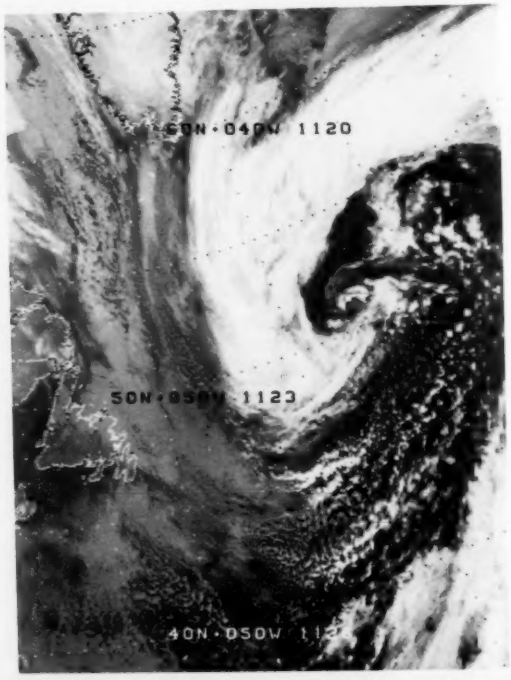


Figure 34.--The hook shape to the high level clouds gives a vicious image.

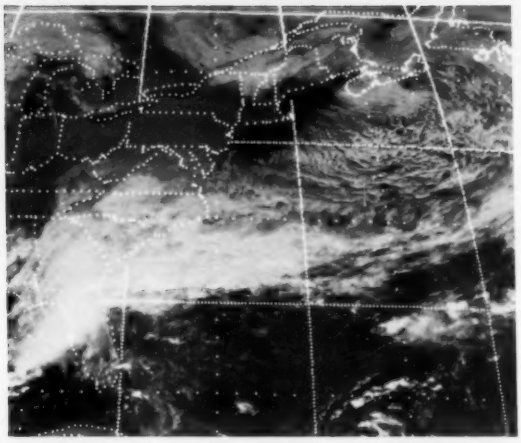


Figure 35. Note the difference in the structure of the clouds off the New England coast where the wind is northwesterly and off the Carolinas where the wind is northeasterly.

can registry. The LACKENBY (46°N, 46°W) had 55-kn winds and waves of 33 ft. The AMERICAN LEGEND (48°N, 29°W) found 45-kn winds and 29-ft waves. At 1800 the AMERICAN ACCORD (49°N, 39°W) reported 56-kn winds driving 46-ft seas. Her high winds and waves continued into the 26th, when she reported 41-ft waves at 1200. Several ships had 60-kn winds in the northwesterly flow. The storm deteriorated rapidly on the 27th and crossed north of Scotland and into Norway and then into Russia. The storm had traveled from longitude 115°W to 45°E.

On the 23d there was a large 1039-mb HIGH centered between Lake Huron and James Bay. Northeasterly winds of 10 to 30 kn were blowing off the Carolina coast north of a stationary front stretching east-west across Florida. A weak frontal wave moved across Florida and was off Jacksonville on the 0000 chart of the 24th (fig. 35). Late on the 23d the BARBER PERSEUS was sailing northeastward along the Gulf Stream. At 1900 she reduced speed due to heavy weather. At 2220 at 31°21'N, 78°56'W, on a course of 41°, she was hit by a freak wave which damaged containers on the deck of the 21,747-ton vessel (fig. 36). At the time the weather was: wind NE 7, barometer 1014.8, wet bulb temperature 24°C, dry bulb temperature 25°C. The following

Figure 36.--One of the damaged containers aboard the BARGER PERSEUS. Photo courtesy of the crew.

was extracted from the ship log: "We hit a twin freak wave--went over the top of the first one and down the other side straight into the second wave, which completely engulfed forward section of the ship. The ship at the time was doing about 10 kn but was stopped by the wave completely. The sea was increased in size by the fact that it was completely opposed by the current of the Gulf Stream. The wave caused extensive damage to forward containers on deck. Approximate height of containers above sea level was 62 ft. None of the ship's structure was damaged as the wave carried over the top of the forecastle."

This frontal wave was first analyzed late on the 28th south of Cape Sable. It moved rapidly northeastward and was south of Cape Race at 1200 on the 29th. The CG26 near 44°N, 64°W, had 47-kn northwesterly winds. By 1200 on the 30th the storm was 976 mb near 57°N, 32°W (fig. 37). The higher winds and waves were east of the center. The MANCHESTER CONCORDE (56°N, 29°W) was hit by 52-kn winds driving 25-ft seas and 33-ft swells. Nearby the KING WILLIAM had 60-kn winds, but the waves were only 20 ft. Behing the cold front at 45°N, 44°W, the IXIA had 40 kn with seas of 20 ft and swells of 25 ft. Lima had 47-kn winds and 23-ft waves at 0000 on the 31st. At 0600 she measured 59 kn and 30-ft waves. Many ships were reporting gale to storm winds with waves as high as 33 ft that day. The storm was now moving due north, but on November 1 it turned northwestward and made a loop south of the Denmark Strait. Most of the high winds were now east of the front which paralleled longitude 10°W. An exception was the JUTHLANDIA near 59°N, 32°W, with 50 kn. On the 2d the weakened storm raced northward through the Denmark Strait.

Figure 37.--There appears that a circulation may have been forming at the occlusion (48°N, 35°W).

Tropical Cyclones--Out of a nontropical LOW in the eastern North Atlantic came hurricane Ivan on the 5th. Spawned some 500 mi south of the western Azores, the storm headed southward then swang west-northwestward on the 7th. Ivan was of hurricane strength from the 6th through the 11th. Peak winds were estimated at about 85 kn on the 9th and 10th as Ivan headed north-northeastward. He passed about 350 mi west of the westernmost Azores on the 10th. Accelerating to a 40-kn forward speed, Ivan merged with a cold front in northern waters on the 11th (fig. 38). The HIJAZ from Jeddah to New York reported running into Ivan on the 10th and losing 56 containers overboard.

Figure 38.--Hurricane Ivan is about to merge with the cold front on the 11th.

Casualties--Twenty-two people were rescued from the burning 4,640-ton Swedish FINNEAGLE by helicopters in 65-kn winds and 25-ft waves. The ship, loaded with carbide, had run out of fuel about 70 mi northwest of Orkney. The 560-ton LUGELA and the 304-ton JAQUETON collided in fog 5 mi north of Cape Finisterre on the 5th. The GARDNO sprang a leak in heavy weather off Norway on the 7th. The 300-ton Danish RANDI DANIA capsized in heavy weather off Corunna on the 7th while trying to assist the British yacht BARTHOLOMEW

TIFFING. Four of the crew of six were rescued. The Greek bulkcarrier MEDSTAR (11,082 tons) encountered heavy weather on the 7th to 10th on voyage from Florida to Italy.

The SEA CARRIER I grounded in high winds inbound to the port of Colchester on the 9th. On the 10th a seaman was rescued from the crew quarters of an overturned barge towed by the tug CRAIGLEITH off the Isle of Wight. He survived for 2 hr in an air bubble. Early on the 11th the trawler ELODIE capsized in 80-kn winds off St. Nazaire, France. Two of six crewmen were rescued and two more of three trapped inside the hull for 36 hr were rescued by divers. In the same area an 8,000-ton vessel being towed to a scrapyard snapped the tow line.

On the 13th the 1,000-ton gas tanker GAZ EAST sank in high winds off the south coast of France. All 15 aboard were rescued. The tank barge TORDUCT grounded in fog off Essex. The LASH barge CG-170 arrived Bilbao with weather damage. A fire aboard the Italian MADDALENA LOFARO may have been caused by sparks generated by the movement of cars in hold during heavy weather. The Greek bulkcarrier AEGIS PROGRESS sustained heavy-weather damage during October 14 to 17 from the Suez Canal to Szczecin.

On the 15th the AMYNTAS and the SILVER STAR contacted in a rain storm in the outer anchorage of Cristobal. The ferry WANDS BEK and the tug BAHIA collided in fog near Hamburg.

The Liberian bulkcarrier NAVIOS PATRIOT suffered weather damage on a ballast voyage from Setubal to Port Cartier during the 23d to the 30th. The Egyptian EIHAB I encountered heavy weather with damage on the 26th and 27th on the Mediterranean Sea. The ferry EUROPAFARJAN with 130 passengers ran aground off Grena, Denmark, in stormy weather on the 27th. No one was injured. The 1,027-ton REPULSE BAY reported an earlier encounter with heavy weather. The 4,596-ton LPG carrier MONOMER VENTURE dragged anchor at Coatzacoalcos on the 29th in strong northerly winds. The Russian OLENEK in tow of salvage tug HERMES called at Bremerhaven on the 31st due to heavy weather. The Greek-registered UHENFELS had weather damage on a voyage from Rotterdam to Buenos Aires.

The 11,421-ton American POET departed Philadelphia on the 24th. She gave a position report on the 25th after leaving Cape Henlopen and was not heard from again. A developing LOW was over Cape Henlopen at 1200 on the 25th and may have been a factor in the ship's disappearance.

ROUGH LOG, NOVEMBER 1980--The extratropical traffic across the North Atlantic was light this month. Several of the storms were very large. The primary storm track was across the Great Lakes; it was joined by a secondary track east of Nova Scotia off the East Coast. The track then continued to the Faeroe Islands. There was a cluster of storm paths over Canada north of latitude 55°N, but they remained over that area with one exception. Another primary track originated west of Portugal and extended eastward across the northern Mediterranean Sea. These paths were quite different from climatology.

The major sea-level pressure feature was the displaced 1002-mb Icelandic Low. It was centered near 47°N, 42°W, about 1,000 mi southwest of its usual position. There was a 1003-mb Low center north of the White Sea and a 1008-mb center over the northeastern edge of Hudson Bay. The Azores High was 1021 mb near 29°N, 23°W, about 500 mi southeast of its usual location.

The displacement of the Icelandic Low resulted in a large negative anomaly of 14 mb centered near 43°N, 40°W. A minus 11 mb anomaly was located over northern U.S.S.R. The mean pressure over Iceland was 10 mb higher than normal.

The flow at 700 mb was zonal from the eastern United States to about longitude 40°W, where it turned northeastward in the higher latitudes in response to a ridge off the European coast. South of latitude 40°N, it remained zonal with slight waving across the Mediterranean.

Jeanne and Karl were rare November hurricanes. Since 1930, there have been only seven other hurricanes during this month and never more than one.

Extratropical Cyclones--The first significant storm of the month was short-lived. A report by the RODIN at 1200 on the 3d helped analyze a new LOW in a sharpening trough. The LOW raced northeastward while deepening and was near 51°N, 33°W, by 1200 on the 4th. A large HIGH blocked further eastward movement and tightened the gradient in the eastern circulation. The CARCHESTER (49°N, 24°W) had 30-ft swells and the MIROSLAWIEC (42°N, 24°W) had 54-kn winds. Ships on the west side had winds in the 40-kn category. The LOW was north of OWS Charlie on the 5th, leaving 47-kn winds and 21-ft seas behind. The FRANK SCHROEDER (42°N, 36°W) was sailing into 30-ft waves all day. Many ships had waves over 20 ft. The storm was gone on the 6th.

This storm originated as a frontal wave on the 7th. A ship at the front found confused, 20-ft waves (fig. 39).

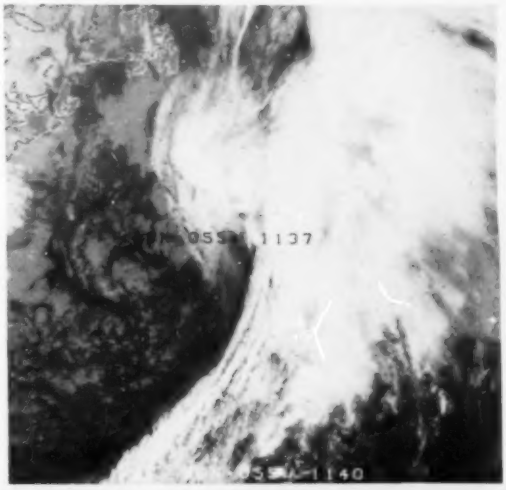


Figure 39.--The bulge in the high-level clouds indicates the frontal wave below.

The Greek ore carrier DAPO ALECOS sustained weather damage and had to be put aground at Mooring Cove, Newfoundland. By 1200 on the 8th the storm had developed a good circulation around the center. The ERLANGEN EXPRESS (42°N, 34°W), 400 mi southeast of the center, had 58-kn winds with 33-ft waves. The CARCHESTER, 500 mi south of the center, had 60-kn winds with 49-ft waves on her starboard bow. The SEA-LAND PACER suffered only 50 kn and 20-ft waves. This luck did not hold as the waves were 30 ft on the 9th. The storm was weakening on the 10th, but a ship had 52-kn winds immediately west of the center.

On the 12th the storm moved along the north coast of Spain. A ship off Portugal had 47-kn winds. The LOW moved across Sardegna on the 13th. There were some gales south of France, but they dissipated on the 14th.

A storm was moving across the Great Lakes on the 9th. By the 10th a wave had formed on the front over Long Island. By 0000 on the 11th it had absorbed the original storm and vastly expanded with accompanying ga 's. At 1200 on the 11th the storm was 976 mb near 43°N, 52°W, with two centers. Ships were reporting 40- to 50-kn winds with waves up to 25 ft in the southwest quadrant. On the 12th the MIROSLAWIEC (35°N, 60°W) again had over 50-kn winds and 33-ft waves. On the 1200 scan there were many 40- to 55-kn wind reports with high seas. The highest was 39 ft (fig. 40). The KING WILLIAM among many others was having a bad time on the 13th with winds near 60 kn and waves up to 33 ft. The BAKKAFOSS, north of the center at 57°N, 45°W, battled 60-kn northeasterly winds, but as usual the Icelandic ship did not report waves. By the 14th another center formed east of the main 972-mb center. The storm was weakening with mostly gales reported. The new center brought gales to the North Sea.

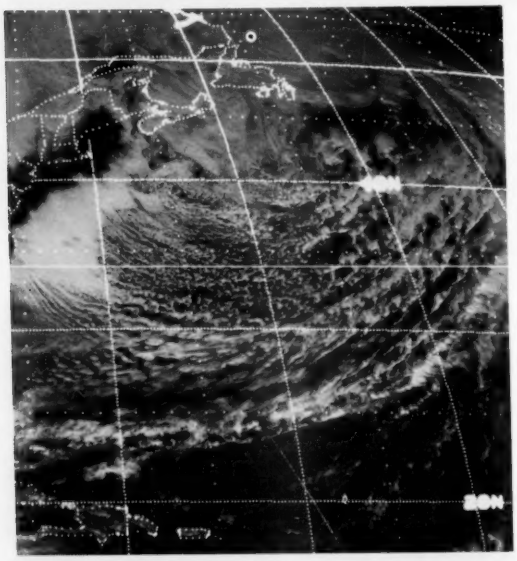


Figure 40.--Typical instability-type clouds when cold air moves over warmer water outline this storm.

On the 16th a frontal wave came out of the south and passed east of the main center. The VIKING BULKER south of the two centers had 45-kn winds and 25-ft waves. On the 17th the two LOWs came under the influence of zonal flow and raced off to the east. OWS Romeo had 30-ft waves. As the storm moved over Scotland, the North Sea was subjected to gales. The storm stalled over the Gulf of Finland on the 19th.

This LOW formed in the wake of the storm above with the combination of a frontal wave and a weak LOW early on the 17th. By 0000 on the 18th the central pressure had plunged to 970 mb near 48°N, 44°W (fig. 41).

Figure 41.--The storm has drifted eastward when this image was observed 10 hr later. Note the multiple layers of clouds northeast of the center.

The APOLLONIA (47°N, 48°W) had 983 mb with 55-kn winds. By 1200 the chart was saturated with winds over 40 kn. The highest on the radio printout was 68 kn near 40°N, 30°W, by the MANISTEE. The German ship DILZ had 39-ft seas. The high winds and waves continued as the central pressure dropped to 960 mb at 1800 on the 18th. On the 19th the MAIRANGI BAY found 49-ft swells near 41°N, 36°W.

Another strong storm was following this one, which was weakening as it separated from the outflow of the

primary upper air LOW. There were again high winds around the United Kingdom as the storm sped eastward.

Cape Hatteras makes another contribution. This storm traveled along the East Coast on the 18th and deepened gradually. Gales had already started by 0000 on the 19th. By 1200 the storm was 968 mb less than 100 mi northeast of Sable Island (fig. 42). The GREEN ISLAND

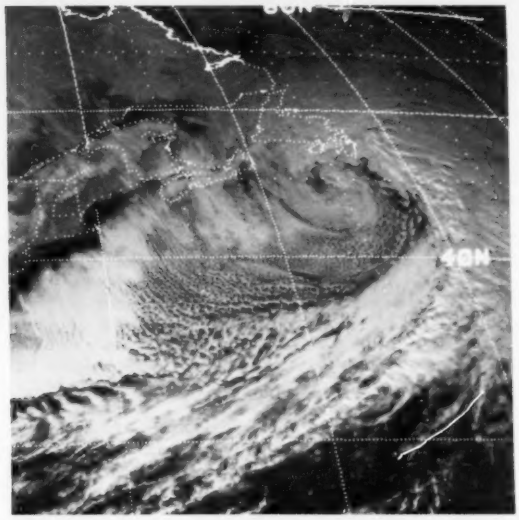


Figure 42.--At 1700 the storm was centered south of Cape Race.

had 50-kn winds very near the cold front 600 mi south of the center. At 1200 on the 20th the storm was 956 mb near 49°N, 47°W. SEDCO measured 58-kn winds, and the ERLANGEN EXPRESS (50°N, 49°W) was 17 mb west of the center with 60-kn winds and 39-ft waves. There were several reports of winds over 50 kn and waves over 30 ft. The ASPEN CARRIER (5,352 tons) radioed that she encountered heavy weather in latitude 41.9°N, 46°W. Derricks and hatches were damaged and a truck was lost overboard with others damaged.

This storm combined with the circulation of the prior storm covered most of the ocean north of latitude 35°N with severe weather. Strong winds and high waves continued into the 22d when the storm started relaxing and was only a trough by the 23d. Another had already come off the East Coast.

An inverted trough off Florida gave birth to this LOW. The storm was 984 mb west of Cape Cod at 1200 on the 22d. The VC96 at 43°N, 65°W, had easterly 64-kn winds. Others to the south had 50 kn. Twenty-four hours later at 1200 on the 23d the LOW was 968 mb near 39°N, 55°W. A German ship near 38°N, 63°W, reported 49-ft swells. The DEL VALLE very near the same location reported 69-kn northerly winds and 39-ft waves.

This storm was traveling slightly south of east, not the usual path. Winds of 50 kn and waves higher than 25 ft continued. The MONTFORT (30°N, 45°W) had 66-kn winds with 30-ft swells and the AMERICAN LEGEND (37°N, 60°W) suffered with 45-kn winds driving 26-ft seas and 33-ft swells. On the 25th the higher winds were running from 40 to 55 kn and the waves to over 25 ft. The 16,984-ton KAPETAN GEORGIS (31.5°N, 56.7°W) sustained dangerous weather damage by giant waves (fig. 43).

Figure 43.--When this image was sensed at 1137, it showed a small typical hurricane configuration complete with eye.

Now for a significant reverse of the usual. Many tropical storms turn extratropical as they travel northward. This extratropical storm became tropical and was labeled hurricane Karl at 1600 on the 25th. From the weather reports it appeared that many ships had rerouted away from the storm by this time. On the 26th the reports were in the gale range with waves of about 20 ft. The SEA-LAND CONSUMER (40°N, 33°W) had 30-ft swells from the southeast. The storm started to fall apart on the 27th and had dissipated by the 28th, as yet another strong extratropical storm moved southeastward.

As a front moved over the U.S. East Coast on the 25th, a wave formed near Cape Cod. Ships along the coast were finding 40- to 45-kn winds. On the 27th the outer circulation enveloped both this storm and Karl (fig. 44).

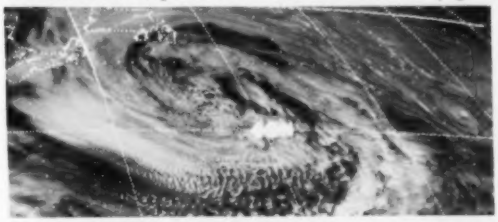


Figure 44.--The storm is centered southeast of Cape Race. Hurricane Karl can be seen on the edge near 42°N, 32°W.

A Netherlands Antilles ship PJYS near 37°N, 59°W, called the winds 63 kn and the waves 46 ft among other things. The ROS CASTLE (36°N, 56°W) found the winds to be 60 kn and the waves 41 ft. She had waves over 25 ft into the 29th. At 0000 on the 28th the ANCO PRINCESS near 34°N, 50°W, about 400 mi south-southwest of the 986-mb center found the winds to be 70 kn and the waves 26 ft. On the 29th the winds were generally below 50 kn and the highest waves 25 ft. On the 30th the JOULE (50°N, 28°W) found 39-ft southeasterly swell waves. Later in the day the storm started falling apart and was gone by the 3d.

Tropical Cyclones--On the 8th a late-season tropical depression formed in the Caribbean some 200 mi west of Grand Cayman Island. Drifting northwestward, the system was christened tropical storm Jeanne the following day. She moved just west of Cuba's Pt. Cajon on the 10th as winds near her center climbed to 50 kn. Once through the Yucatan Channel Jeanne's movement became slow and erratic. Gales extended 150 mi to the north of her center. In combination with a large HIGH over the eastern United States, strong winds and rough seas were being encountered in the northern Gulf of Mexico. On the morning of the 11th Jeanne became a minimal hurricane as winds climbed to 64 kn around her center, where a 980-mb pressure was recorded. Jeanne was still meandering or nearly stationary until the 12th. Finally, she started a slow westward movement. On the 13th the hurricane turned toward the northwest, crossed the 25th meridian near 91°W, then turned westward again--this time as a tropical storm. Tides of 3 to 5 ft pounded the Texas and Louisiana coasts as Jeanne moved toward southern Texas. However, on the 14th the weakening system, after coming within 125 mi of Brownsville, reversed its direction and headed eastward then east-northeastward. The following day she was downgraded to depression strength and interacted with a cold front to the northeast.

Hurricane Karl was discussed under extratropical cyclones.

Casualties--The Danish schooner CREOLE arrived Las Palmas on the 5th with weather damage. The 500-ton German coaster KAAKSBURG was blown aground (cover) on the Isle of Fundy on the 5th. All seven aboard jumped to the rocky beach. The SIBA EDOLO and the FAITH SULTAN collided in fog in the Bosporus Sea on the 8th. The 138-ton Turkish UZ RUZGOR grounded on the 10th due to bad weather. The CITY OF LEEDS grounded while at anchor at Antalya during a storm.

The tanker LUCOR MANOR collided with the barge ES-CHRI-JU while maneuvering in the port of Antwerp in dense fog on the 10th. The barges TOSCANA and CLOTAIRE were also involved. The INDIAN VALOUR had to put back to Liverpool on the 15th due to storm damage. The Italian livestock carrier PEZZATA ROSSA and the YEOTA E. collided on the 17th in fog off the Turkish coast. The DOPAS dragged anchor in high winds at East Mersa on the 17th. She refloated on high tide.

The JOANNIS MARTINOS arrived Piraeus on the 22d after having lost 100 small containers from the deck during heavy weather off Malta. The Libyan EBN MAGID sustained heavy weather damage off France on the 21st. The CASTOR 1 broke down near 50.5°N, 04.8°W, in gales. The crew of 12 was evacuated by helicopter. She dragged anchor and wrecked near Tintagel Head. On the 28th the British DARNIA was struck by a huge wave off Lock Ryan and developed a 6° list when vehicles shifted. The crew of 15 was rescued from the British ST. IRENE in gale-force winds 18 mi off the Netherlands.

Rough Log, North Pacific Weather

October and November 1980

ROUGH LOG, OCTOBER 1980--The storm systems this month were reversed from what might be expected. The first half of the month there were a few large storms, while the last half of the month there were many smaller systems. One would expect the opposite trend with the winter season approaching. The primary storm track came out of the Sea of Japan across the La Perouse Strait and continued eastward south of the Aleutians into the Gulf of Alaska, where it turned sharply northward. A few storms formed in the climatic area of principal cyclogenesis east of Japan, traveled northeastward, and joined the primary track near 180°. Additional cyclones that came into being southwest of the Gulf of Alaska contributed to the congested storm traffic over the Gulf.

The mean sea-level pressure closely matched the climatic mean. The 998-mb Aleutian Low near 54°N, 158°W, was about 200 mi south of its 1001-mb climatic counterpart. The Pacific High had a long, narrow east-west configuration along latitude 32°N with two 1022-mb centers at each end near 33°N, 136°W, and 32°N, 179°W. These were 3 mb higher than climatology. North of latitude 40°N the pressure departures were generally negative with a minus 7-mb anomaly center near 50°N, 160°W. South of 40°N the sea-level pressure was generally higher than normal. An exception was a plus 5-mb anomaly center over the mountains of British Columbia.

The upper air flow was primarily zonal over the midlatitudes from the Asian coast to 160°W. There were long-wave troughs slightly interior of the Asian coast and approximating 155°W longitude. The ridge over western North America was steeper than normal. As at the surface, the pressure heights were lower than normal north of latitude 40°N, except in western Canada, and higher south of that latitude.

There were four tropical cyclones over the western ocean: typhoons Wynne and Betty and tropical storms Alex and Cary. Over the eastern ocean there were two tropical storms, Madeline and Newton.

Extratropical Cyclones--The first week of the month the Pacific High was over the central ocean with low-pressure systems moving across the northern waters.

During the first 2 weeks there were low-pressure centers off the North American coast. The Pacific High drifted eastward during the third week and weekend to reappear over the central ocean the fourth week. During the last 2 weeks of the month the ocean was dominated by many small pressure cells. The first few days of the month the ocean was affected by a September storm.

The first significant extratropical storm was the transformation of typhoon Vernon. By 1200 on the 4th Vernon had completely incorporated a frontal system into the circulation. The AKAISHI MARU was west of the storm with 44-kn winds and 23-ft waves at 1800. At 2100 the FORSYTHIA radioed a wind report of 66 kn, while about 200 mi north of the storm. On the 0000 analysis of the 5th, the 964-mb storm was near 48°N, 174°E. Two ships, including the SILVERFJORD, had winds of 60 kn or over and swell waves to 33 ft. The SILVERFJORD near 46°N, 175°E, had a pressure of 969 mb. Others were reporting winds near 50 kn and waves of 20 to 30 ft. At 0300 her wind report read 80 kn and the barometer at 963.7 mb indicated she was very near the center of the storm. The wind waves were 20 ft, but the swell wave read code 50, which was probably an error in the communications. If not, a description from the ship would be appreciated.

By 0000 on the 6th the storm was 966 mb near 51°N, 168°W (fig. 45). The SUNNY PIONEER (48°N, 177°W) found 46-kn winds and seas and swells were coded as 59 ft. Other ships were reporting about 20-ft waves in that area. On the 7th the KHRH (43°N, 169°W) had 45-kn winds with 20-ft waves. Later the buoy 46003 measured 40-kn winds, and a ship on the southwestern edge of the storm had 23-ft waves. At this time a second center formed north of this one. By 1200 the original center could not be identified, and the new one died over Alaska by the 9th.

Figure 45.--The surface center is obscured, but the diffuse upper clouds indicate approximately 49°N, 170°W, at 2032 on the 5th.

This storm came out of Manchuria and was north of the La Perouse Strait late on the 7th. It moved northeastward and was 974 mb on the 9th over the Kamchatka Peninsula. A station on the west coast measured 40 kn. St. Paul Island measured winds of 37 kn with gusts to 44 kn. The GREEN AUKLET at 52°N, 165°E, had 45-kn winds and 20-ft waves at 0000 on the 10th. At 0600 the OHMINESAN MARU on the Bering Sea at 60°N, 178°W, had 48-kn winds from the southeast. Far to the south the HAKUZAN MARU (47°N, 165°E) encountered 20-ft swell waves in light winds. On the 11th the storm was north of 60°N and weakening. There were still a few gale reports. On the 13th the storm broke into multiple centers, which reunited on the 14th and moved over the Seward Peninsula.

As typhoon Wynne traveled along the south coast of Honshu, an extratropical LOW formed east of Hokkaido on the 14th. There was a small anomalous LOW in the warm sector, and the KHOUDOJNIK GUERASSIMOV was in its southern edge with 60-kn winds and 20-ft seas. The SHINZUI MARU (46°N, 155°E) was behind the cold front with 50-kn winds.

By 1200 on the 15th the LOW had dropped to 964 mb near 51°N, 174°E. The SEA-LAND MCLEAN was 550 mi east of the storm with southeasterly 48-kn winds. The CLOVER was due south of the center at 38°N with 30-ft seas and 39-ft swells as she passed through a trough line. The towline from the tug SMIT NEW YORK to the drilling platform DAN PRINCE snapped the night of the 15th about 400 mi south of Dutch Harbour (fig. 46). The helicopter pad was destroyed in 40-

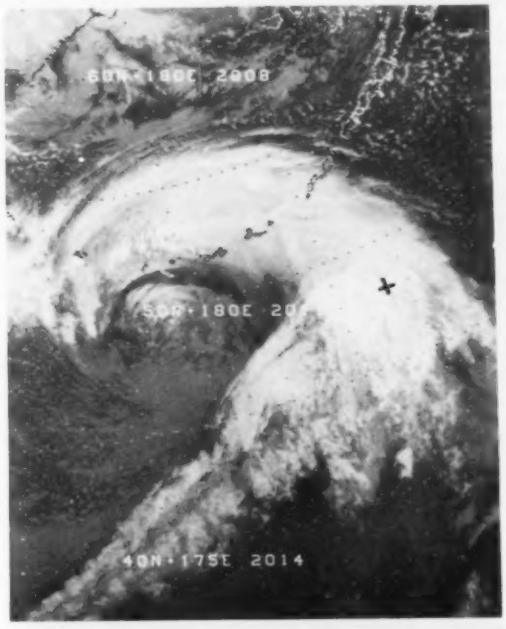


Figure 46.--The plus sign (+) indicates the approximate location of the DAN PRINCE and SMIT NEW YORK in relation to the storm.

ft waves and force 12 winds. The tow was reconnected on the 19th; but the drill stem broke loose and the crew evacuated on the 21st. They were taken aboard the CGC BOUTWELL. The rig capsized on the 22d and sank. Cold Bay, Alaska, measured winds of 36 kn. On the 16th there were four ships in the southwest quadrant near the cold front with gales. The central pressure was now 960 mb. At 1200 the NOAA ship DISCOVERER was near 54°N, 165°W, and measured 44-kn easterly winds. Her pressure was 969.5 mb. A ship near 44°N, 179°W, had 26-ft waves. On the 17th the storm was turning northward. There were several ships in the southern half of the storm with gales. Three ships in the vicinity of 49°N, 156°W, had winds between 40 and 55 kn with waves of 30 to 36 ft. At 0000 on the 18th the SOUTH EXPRESS at 49°N, 156°W, had 55-kn northeasterly winds and 43-ft waves. Later in the day OWS Papa had 42 kn and 20-ft seas. On the 19th the ASIA INDUSTRY (47°N, 166°W) had 26-ft swell waves. In the southerly flow a ship had 23-ft swells. The LOW was west of the Alaska Range on the 20th and the ALASKA STANDARD was sailing out of Valdez near Montague Island and found 60-kn east-southeasterly winds with 33-ft waves. Six hours later the winds had dropped to 50 kn, but the waves were still 33 ft. On the 21st the LOW disappeared near Point Barrow as another strong storm entered the Gulf.

This was another storm that came out of Manchuria. After the LOW crossed Kamchatka on the 18th, it deepened and expanded. A ship near 51°N, 163°E, found 51-kn northwesterly winds with 36-ft swells on the 19th. A Soviet ship south of Ostrov Beringa reported 55-kn winds. The storm was still strengthening on the 20th as the TOYOTA MARU No. 10 encountered 33-ft swell waves near 45°N and the Date Line. The CGC BOUTWELL caught 40-kn winds and 25-ft seas just east of the front about 500 mi south of Unimak Island. Papa measured 57-kn winds at 1500. On the 21st an American ship designated as KHRP (45°N, 153°W) also slightly east of the front had southeasterly 48-kn winds and 33-ft waves (fig. 47).

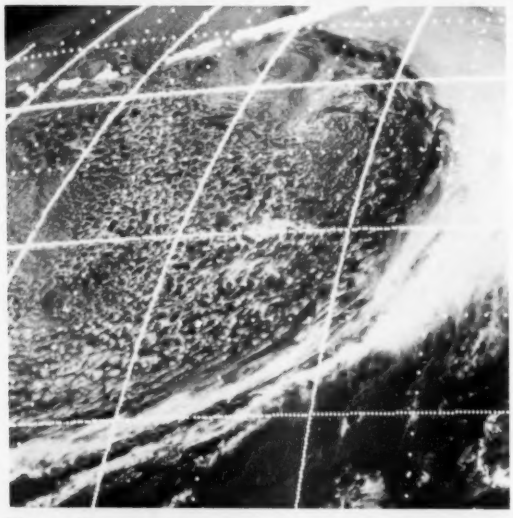


Figure 47.--The storm was south of the Shumagen Islands at 2045 on the 21st.

On the 22d the storm was 976 mb south of Kodiak. The FEDSTEEL was west of the Queen Charlotte Islands with 60-kn winds. Waves of 20 to 25 ft were still being generated in the southwestern quadrant of the storm. New low centers had now formed both north and south of the original center, and by the 23d it disappeared. The stronger winds and high waves were now in the southerly flow. Late in the day the SOHIO INTREPID (53°N, 140°W) had 45-kn winds with 20-ft seas and 25-ft swells. The northern center was tracking northwestward over the Bering Sea, and the southern center tracked northeastward toward Yakutat. On the 24th the NEWARK and another SHIP were within a few miles of each other near 54°N, 138°W, with 65- and 50-kn winds and 23- and 33-ft waves, respectively. The LOW turned northwestward then northward through Cook Inlet. As the front moved inland, it took the high winds with it. The LOW continued into the Beaufort Sea.

Tropical Cyclones, Western Pacific--Supertyphoon Wynne was spotted south of Truk on the 4th. The tropical storm was heading toward the northwest. This brought her close to Guam just after 1200 on the 6th. Wynne remained a tropical storm until the 8th (fig. 48) after turning west-northwestward. She then literally exploded as winds increased from 70 kn at 1200 on the 8th to 150 kn some 24 hr later as the supertyphoon crossed the 135th meridian near 19°N. Gusts were estimated at 180 kn. Minimum sea-level pressure was estimated at about 890 mb. Tip set the record of 870 mb just 1 yr ago. Wynne began to recurve on the 11th as maximum winds fell below 130 kn. The following day she blasted the Ryukyu Islands with 100-kn winds. Okinoerabu Island recorded a gust of 91 kn (fig. 49). As Wynne recurved toward the east-northeast on the 13th, she swamped

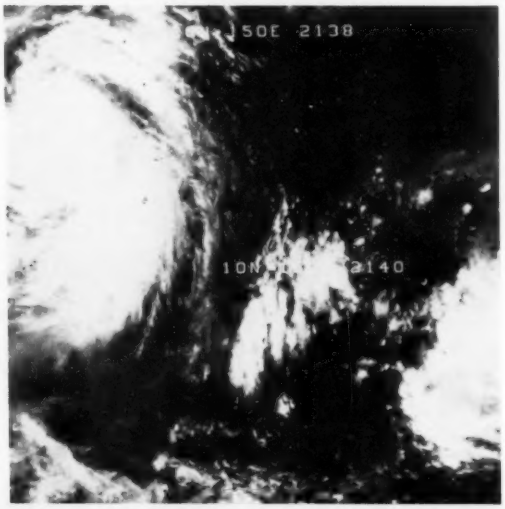


Figure 48.--Tropical storm Wynne at 2139 on the 7th.

Figure 49.--Typhoon Wynne 5 days later on the 12th near the Ryukyu Islands.

hundreds of houses on Kyushu and triggered numerous landslides with her torrential rains. The accelerating storm brushed Honshu on its southern coast before moving out to sea on the 14th. Winds were still at typhoon force, but the storm was weakening and turning extratropical. In her wake Wynne left three people dead and 26 injured. About 12 boats were lost or damaged. The Panamanian SEMPOR and Korean TEST HWA HO were both blown aground; all crewmembers were rescued.

While Wynne was moving through the Ryukyus, Alex popped up southeast of Iwo Jima. He was a tropical depression on the 12th. The following day Alex was christened just west of Chichi Jima. At this time Alex was moving northwestward toward Japan, which was now being threatened by two storms. However, Alex recurved toward the northeast later on the 13th. He never climbed above minimal tropical storm strength; by the 14th he was weakening rapidly.

Just before the month came to a close typhoon Betty developed on the 29th near Truk, while tropical storm Cary came to life over southern Luzon. Both headed west-northwestward. Cary reached tropical-storm strength over the South China Sea on the 30th--the same day Betty climbed to typhoon strength just south of Guam. On Guam three people were injured and 30 homes were destroyed. Betty altered her course to the west, while Cary made a sharper turn and headed west-southwestward for Vietnam. On the 1st he raked the Paracel Islands with gales and Sanhu Dao, 150 mi north of Cary's center, reported sustained winds of 40 kn with gusts to 62 kn. Meanwhile, Betty was generating 90-kn winds and heading for Luzon moving close to the 15th parallel. As Cary was dissipating 120 mi northeast of Ho Chi Minh Ville on the 2d, Betty continued to wind up as she crossed the 130th meridian near 15°N. As Betty approached Luzon she continued to intensify; she reached a peak of 120 kn on the 4th shortly before barging ashore over Luzon's Sierra Madre Mountains. She was the strongest typhoon to hit the Philippines this year, and a state of emergency was declared in 113 towns throughout eight northern and central Luzon provinces. At least 68 people died and 229,000 were left homeless; 50 people were missing. Two ships under tow, the GENERAL SAN MARTIN and ANCAP CUARTO, took on water during the typhoon and suffered extensive damage. The ANCAP CUARTO was driven aground east of Baguio.

The rugged terrain of Luzon took its toll. Betty recurved along the west coast as a tropical storm. By the 6th she was through the Balintang and Bashi Channels and paralleling the Ryukyu Islands. The following day Betty continued to weaken and turned extratropical.

Tropical Cyclones, Eastern Pacific--Two tropical storms, Madeline and Newton, flared briefly in the eastern Pacific between Socorro and Clipperton Islands. Madeline was a 2-day wonder as maximum winds climbed to about 45 kn late on the 11th. The following day the northwestward-moving storm began to peter out near 16°N, 111°E. This was about where Newton was born more than 2 weeks later, on the 28th. Newton reached minimal tropical-storm strength as he meandered eastward. However, the following day he was a dissipating depression about 100 mi southwest of Mazatlan.

Casualties--The 8,566-ton cruise liner PRINSENDAM (fig. 50) caught fire in the engineroom at 0130 local time (0930Z) on the 4th. The fire became uncontrollable, and 510 passengers and crew abandoned ship at daylight. Air Force and Coast Guard helicopters assisted in the rescue. The waves were 15 to 25 ft, the winds 30 to 50 kn, sea temperature 40°F, and air temperature 50°F. Most of the people were put aboard the WILLIAMSBURGH and CGC BOUTWELL. The BOUTWELL rescued 18 passengers and 2 Air Force pararescuemen from a lifeboat early on the morning of the 5th. There were no serious casualties. The PRINSENDAM sank on the 11th while still smoldering.

The 11,096-ton Greek SEMI was due Nagoya on the 7th with heavy-weather damage. The 20,747-ton British SILVERFJORD was due Kobe on the 13th with heavy-weather damage. That day the STAR MAGNATE requested a survey at Kobe for weather damage. The 9,026-ton Nigerian RIVER OJI reported heavy weather damage on the 14th. The 10,520-ton bulkcarrier GRAND GLOBE had weather damage on a voyage from Vancouver to Yokohama.

The 26,456-ton American PRESIDENT GRANT and the 80-ft fishing vessel MARTIN HIGGINS collided in fog outside the Golden Gate Bridge on the 22d. The 8,503-ton EUROTRADER from Singapore for North Korea claimed heavy weather from the 21st to the 30th with force 10 to 12 winds. Vessel beached in Pesca-

Figure 50.--The fire-ravaged hulk of the cruise ship PRINSENDAM is about to take the final plunge. U.S. Coast Guard Photo.

dores Islands and plundered after abandonment by the crew. The bulkcarrier SOUTH GLORY was due Mizushima on the 31st with weather damage. The ALENDALE was repaired in Japan for heavy-weather damage.

Other Casualties--The 3,747-ton POLAR PARAGUAY dragged anchor in strong winds at Melbourne on the 3d. The NANCY HEATH encountered heavy weather enroute to Melbourne. The IRON SHORTLAND had weather damage from Newcastle to Port Hedland. The SNOW WHITE had heavy weather on the 13th and 14th during a voyage from Kyushu to Saudi Arabia.

ROUGH LOG, NOVEMBER 1980--The primary storm path originated in the proper place this month, over Sakhalin Island, but it tracked due east instead of northeastward as climatology dictates. A secondary track started off Japan and joined the primary one as it moved into the Gulf of Alaska. Another track began 600 mi south of Dutch Harbor and moved into the lower Gulf of Alaska.

The sea-level pressure pattern closely resembled climatology. The Aleutian Low was 995 mb about 100 mi south of Kodiak Island. A second 999-mb Low was on 180° near 55°N. The climatic normal shows three Lows along latitude 53°N of 1001 and 1002 mb. The Pacific High was 1024 mb near 32°N, 133°W, about 500 mi east of its usual position and 4 mb higher in pressure.

The anomalies were relatively small. There were two minus 8-mb centers, one near Anchorage and the other over the northern Sea of Okhotsk. There was a small plus 4-mb anomaly center west of San Francisco. Also, there was a large positive anomaly area with a 13-mb center near 85°N, 170°W, over the Arctic Ocean.

The upper air flow was primarily zonal over water, except for a trough approximating 160°W and a ridge over the Rocky Mountains.

Typhoon Dinah roamed the western ocean.

Extratropical Cyclones--The first storm of the month came out of a sharp trough east of Japan. The first strong winds were 50 kn with waves of 28 ft reported by the OSLO VENTURE (35°N, 156°E) about 500 mi

southwest of the center. By 0000 on the 5th the storm was 972 mb near 41°N, 177°W. Several ships reported gales, and the ATLANTIC PIONEER (38°N, 176°W) had 55-kn winds. The next day the central pressure was 964 mb. The PRESIDENT POLK (43°N, 158°W) had 45-kn winds, as did the NEPTUNE DIAMOND (46°N, 164°W) with 30-ft waves. Another ship had 52 kn. On the 7th the MEIHOU MARU, 250 mi south of the center, discovered 33-ft swell waves. A second center to the northeast had formed at this time, and by 1200 it dominated the circulation. There were only gales at this time. The storm moved across the mountains into interior Canada.

This frontal wave formed on a front out of a LOW that moved out of Asia. By 1200 on the 8th the two LOWs had combined. At 0000 on the 9th the storm was 966 mb. The circulation covered half of the ocean north of 40°N. The EASTERN HOPE (47°N, 172°E) near the point of occlusion had 45-kn winds and 30-ft waves. The PRESIDENT KENNEDY (43°N, 149°E) found 47 kn and 23 ft. At 1200 the storm was 947 mb as measured by Ostrov Beringa. The 0000 scan of the 10th had a Soviet ship near 52°N, 165°E, with 62-kn winds and 30-ft waves and the GRAND GLOBE (53°N, 168°E) with 60-kn winds and seas and swells of code 40 (66 ft). This could have been a transmission error, but the ALASKA MARU nearby at 52°N, 170°E, reported 66-ft swell waves. Six and twelve hours later she reported 49-ft swell waves. The SEKISHU MARU (46°N, 176°W), 600 mi south-southeast of the 958-mb center, had 64-kn winds and 33-ft seas on her stern. The HIRO MARU (51°N, 169°E) had 34-ft waves. By 1200 they were only 33 ft (fig. 51).

The storm quieted on the 12th as a LOW on the periphery moved into the Gulf of Alaska, and yet another approached from the west along latitude 49°N. By the 14th the original LOW had disappeared.

This storm originated as a frontal wave about halfway between Hawaii and Kodiak. It raced northward. By 1200 on the 15th there were three centers over the Gulf of Alaska with a tight gradient between them and the coast. The OCEANOGRAPHER (50°N, 140°W) measured 52-kn winds and 16-ft waves. The WMCV (53°N, 138°W) had 50 kn and 17-ft seas. By 0000 on the 16th the WNFL and WMCV were reporting 60-kn winds. The PHILADELPHIA came in with the wave honors of 38 ft near 56°N, 142°W. The LOW was inland on the 17th and of no consequence.

A large LOW that came out of Korea was over the west coast of Kamchatka on the 15th. Another weak center was found near 45°N early on the 15th. A ship of Singapore registry near 41°N, 154°E, reported 70-kn winds and 33-ft swells behind the trough on the 15th. On the 16th there were gale reports. At 0000 on the 17th the 972-mb storm was near Umnak Island (fig. 52). The TOYOTA MARU No. 10 was near 48°N, 171°W, with 66-kn winds, 30-ft seas, and 39-ft swells. At 0600 the winds had decreased to 50 kn, but the waves remained the same. When the 18th rolled around the NEWARK (55°N, 139°W) had 45-kn winds and the PRINCE WILLIAM SOUND (54°N, 136°W) had 47-kn winds with 16-ft waves. Other ships south of the storm were experiencing 20- to 25-ft waves. Gales continued into the 19th as the storm moved ashore near Valdez.

Figure 51.--The only circulation apparent at the surface is the one on the left. The circulation on the right is associated with the cold front and an upper air disturbance.

Figure 52.--At 2000 the storm was south of Atka Island.

This storm came off the Asian mainland on the 20th. It was already well organized as it passed over Sakhalin Island. As it passed over the Kurile Islands early on the 20th, a Soviet ship radioed winds of 62 kn and seas of 26 ft. On the 22d the CHIKURU MARU (46°N, 164°E) had 61-kn winds and 26-ft waves. The STREAM HAWSER (48°N, 160°E) reported 49-kn winds and 43-ft seas. Several other ships reported waves near 25 ft.

On the 24th a small LOW and trough were rotating around the circulation. The HONSHU GLORIA (47°N, 172°W) reported 52-ft waves on the west side of the trough. Later in the day the storm weakened as it moved up the Alaska Peninsula. A few gales were still being reported.

A weak LOW was discovered over midocean on the 25th. It moved eastward rapidly. On the 26th there were two centers, and the storm was growing. There were some gale reports. Later in the day the weather became more severe. The AMERICA SUN and another ship near 57°N, 142°W, had winds above 50 kn and 30-ft waves. By the 27th the storm was really blowing about a 950-mb center near 56°N, 145°W (fig. 53). Many ships had winds greater than 50 kn and waves higher than 30 ft. Among them were the WESTWARD VENTURE northwest of and near to the center (955 mb) with 76-kn northerly winds and the Canadian VRCS south of the center with 52-ft swell waves. The storm moved ashore late in the day and quickly fell apart. The SHINKO MARU radioed for assistance after her deck cargo shifted in 30-ft waves 450 mi off British Columbia. OWS Papa went to her aid.

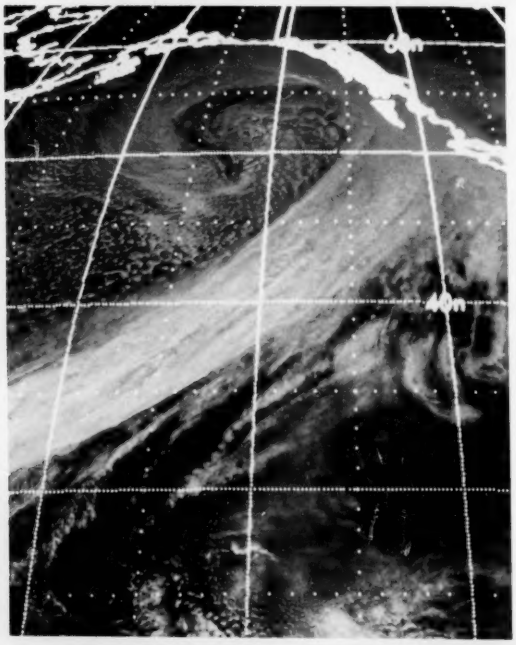


Figure 53.--The storm is sweeping toward the mountainous coast and self-destruction.

Honshu produced this well-built storm. It was already producing storm winds on the 26th around a 980-mb center. Both the ITALY MARU and GBQR in the vicinity of 35°N, 151°E, had 60-kn winds and waves up to 26 ft. The GBQR was sailing eastward with the storm with winds over 60 kn and waves as high as 46 ft. The 26,389-ton Italian bulkcarrier SANDALION took water in two holds when hatch covers broke in heavy weather near 30°N, 159°E. The crew abandoned the vessel on the 29th to the ARAUCO. The fate of the SANDALION was unknown, but it probably sank. At 0000 on the 28th the storm was 968 mb near 43°N, 169°E. Winds over 50 kn with waves over 30 ft continued. The PRESIDENT HOOVER (35°N, 170°E) had 41-ft seas and 49-ft swells on the 29th.

On the 28th a second center was found. It sped off to the east while the original one turned northward. The winds died, but there were still high swell waves in the northwest flow. On December 1 the storm crossed the Chukotskiy peninsula and redeveloped over the Arctic Ocean.

This storm came out of the East China Sea. The LOW was 999 mb east of Tokyo on the 29th. The SIFNA at 35°N, 141°E, found 60-kn winds and 26-ft seas and the ATROPES ISLAND (35°N, 144°E) had 65-kn winds and 23-ft seas at 0000 and 0600, respectively. At 0000 on the 30th (fig. 54), the ORIENTAL STATESMAN was

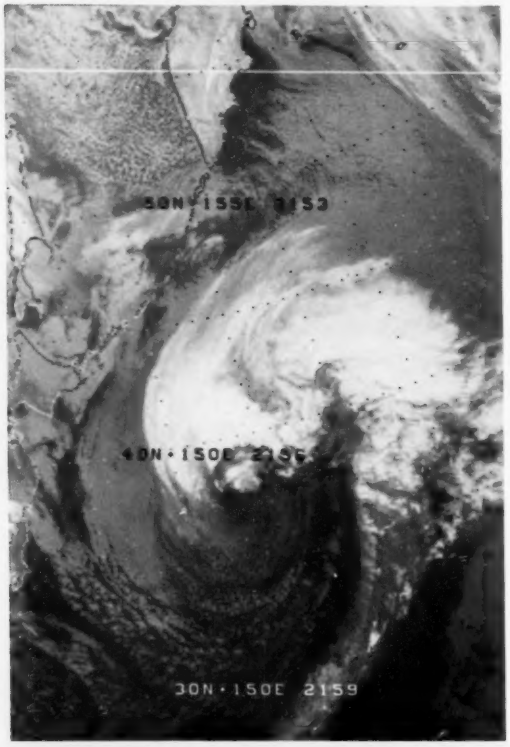


Figure 54.--This is an open center storm. There are only high clouds north of the center.

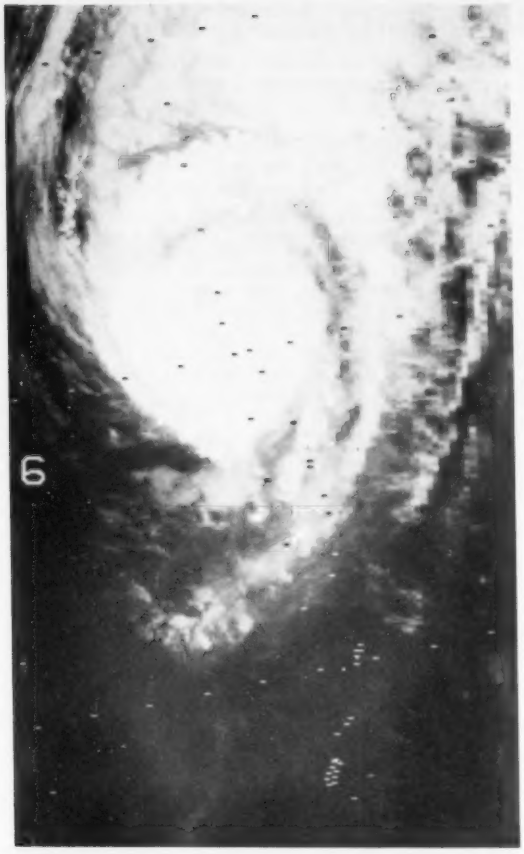


Figure 55.--Typhoon Dinah does not display an eye, but the feeder bands give an indication of her center.

within 2 mb of the 975-mb center with 50-kn winds. The ATLAND (34°N, 154°E) was buffeted by 60-kn winds and 39-ft seas. The KGJF (35°N, 157°E) came through with 56-kn winds and 41-ft swell waves.

The storm was 978 mb on December 1, but for some reason the reported winds were much lighter than expected, although the swell waves reached 30 ft. The central pressure was rising, and the strongest wind on the 2d was 50 kn north of the center. The storm dissipated somewhat on the 3d, but it regenerated on the 4th as it circled counterclockwise south of the Fox Islands. The PRESIDENT JEFFERSON (54°N, 172°W) radioed winds of 55 kn and waves of 23 ft on the 5th. On the 6th the storm was part of a three-center circulation.

Tropical Cyclones--Typhoon Dinah developed on the 21st and moved on a nearly perfect parabolic curve for the next 4 days. The first part of the track took her close to Saipan as winds climbed to a peak of 100 kn early on the 23d (fig. 55). Dinah then swung northward and northeastward passing midway between Iwo Jima and Marcus Island as winds began tapering off. By the 25th the weakening system had crossed the 30th parallel near 160°E.

Casualties--The Greek NAFTOPOROS touched bottom on the 4th near Balboa and developed a list. Vessel was beached on the 5th due to heavy sweli. The Liberian WORLD PRIDE requested a heavy-weather damage survey at Kobe on the 10th. The KRITI EMERALD suffered weather damage on voyage Dammam to Japan during the 11th to 17th. The ORIENTAL TRADER dragged anchor in strong winds at Tsuruga and contacted the EISHIN MARU. The bulkcarrier GRAND GLOBE requested a survey at Kobe on the 17th.

Seventeen crewmembers of the SUNSHINE ISLAND were rescued by the SEA-LAND PATRIOT in heavy seas 1,500 mi east of Japan on the 14th. The tug OCEAN DISCOVERER connected a towline on the 22d, but the towline broke on the 25th in heavy weather from typhoon Dinah. The Chilean ARAUCO needed repairs from weather damage that occurred on voyage from Hong Kong upon arrival at Kobe.

The OINOUSSAI ALPHA, SPECIALIST, and ZEEBRUGGE were all at Kobe with weather damage.

Other Casualties--The TOORONGA had heavy-weather damage at River Yarra on the 2d and 3d. A 200-ton crane barge capsized in bad weather 60 km from Bahrain while in tow. Four barges loaded with timber at Port Kelang were sandwiched between three ocean vessels which strong currents sent crashing into each other. No one was injured, but damage was estimated at $1 million.

Marine Weather Diary

NORTH ATLANTIC, FEBRUARY

WEATHER. The Icelandic Low is 998 mb near 58°N, 37°W. There is a second Low of 1004 mb off the coast of Norway. This combined influence extends south to about latitude 30°N off Florida to 40°N off Portugal. The Azores High is 1020 mb near 30°N, 30°W. The mean pressure gradient across the shipping lanes has relaxed a little. Although the mean storms may be less severe, individual ones may be as bad as in January. The mean surface air temperature ranges from -6°C over the Labrador Sea to 26°C near the Equator. The 0°C isotherm extends from Nordkapp to Kap Farvel to 200 mi east of Cape Race to Cape Cod. Along latitude 40°N it ranges from 2°C at Long Island to 13°C off Portugal increasing to 15°C near the Azores. The 0°C sea-surface temperature parallels the east coast of Greenland, then moves northward in the Labrador Sea to 65°N, then southward around Cape Race to Cape Sable. Along latitude 40°N the sea temperature is 4°C off New Jersey to 14°C off Portugal bulging to 16°C at 40°W.

WINDS. Prevailing winds over most of the Atlantic north of 35°N are from the westerly quadrants, with the exception of an area to the west of the Iberian Peninsula, where they are more northerly. South of 35°N, the prevailing winds are from the east and northeast. Average winds of force 3 to 5 occur over most of the Atlantic north of 30°N, with the exception of an area 400 to 600 mi wide extending from southern Greenland to about 48°N, where they increase to force 5 to 7. The Northeast Trades (25°N to the Equator) and the Mediterranean Sea both observe average winds of force 3 to 5. Easterly winds are predominant over the Gulf of Mexico and Caribbean Sea with an average force 3 to 4 over the Gulf and force 4 to 5 over the Caribbean.

GALES. During February winds of force 8 or greater are confined mainly to north of 30°N. The 10-percent occurrence line extends south from Norway past western Ireland and northern Spain to some 500 mi east of Cape Hatteras, where it turns northeastward and parallels the North American coast to Nova Scotia. The Gulf of Lions is the only region in the Mediterranean Sea with a greater than 10-percent occurrence of gales. The area with the highest frequency, 30 percent, is off the southern tip of Greenland with a surrounding 20-percent area that extends from the Labrador Sea to southern Iceland. Another 20-percent area is located in the Gulf of St. Lawrence.

EXTRATROPICAL CYCLONES. A large area of cyclogenesis extends from the Gulf Coast of the United States to northeastern Newfoundland. Other major areas of cyclone development are over the Denmark Strait-western Iceland region and over the northwest region of the Mediterranean Sea north of a line from Barcelona to central Yugoslavia. Of two primary storm tracks, one crosses the Great Lakes and Bay of Fundy before turning north to the Labrador coast, where it splits with one branch continuing north towards Baffin Bay and the other heading northeastward past the southern tip of Greenland. The other primary track runs from northern Florida northeast to about 50°N, 40°W, where it divides with Lows either heading for the Denmark Strait or the Norwegian Sea. Secondary tracks in the Mediterranean cross southern France and the northern Adriatic, while others lead from northern Spain through southern Italy and northern Greece. Additional secondary tracks cross Hudson Bay and the British Isles.

TROPICAL CYCLONES. Tropical cyclones are such a rare event in February that only one storm has been reported in 100 yr. Its movement was from the Yucatan Peninsula to off the Carolina coast.

WAVE HEIGHTS. North of 25°N, most areas of the North Atlantic, except for protected coastal areas and frozen northern waters, experience wave heights of 12 ft or higher 10 percent or more of the time. Frequencies of 10 percent or more are also observed in the Mediterranean Sea from the Gulf of Lions to near Sardinia and over the Caribbean Sea near Barranquilla, Colombia. The highest frequency, 50 percent, is located north of 42°N and south of 61°N, between southeastern Greenland and 10°W.

VISIBILITY. The frequency of visibilities less than 2 mi reaches 10 percent or more north of a line extending from southern Maine northeastward to northern Iceland and the Barents Sea. Another region of 10 percent or more covers the Irish Sea, English Channel, and southern regions of the North Sea and Baltic Sea. The frequency increases to more than 20 percent over the Gulf of St. Lawrence, along the southeast coast of Greenland, and north of 67°N in the Greenland Sea.

NORTH PACIFIC, FEBRUARY

WEATHER. The Aleutian Low dominates the ocean north of latitude 35°N. The mean central pressure is about 997 mb near 52°N, 170°E. The Pacific High influences the corner of the ocean between Hawaii and California. The Siberian High affects southern Japan and the East China Sea. The mean 0°C isotherm stretches from the Alaska Peninsula to the Tsugaru Strait. The mean air temperature ranges from -18°C at the Bering Strait to 28°C at the Equator. Along the 40th parallel the mean temperatures range from -2°C off the Asian coast to 12°C off California, with 98 percent falling between -12°C and 17°C. The 0°C mean sea-surface temperature extends from the Alaska Peninsula to Tsugaru Strait, but bows northward to 59°N at 180°. The mean temperature at the Equator is 28°C in the western ocean. The mean sea temperature along latitude 40°N is 0°C in the Yellow Sea to 12°C off California.

WINDS. The general wind flow south of 25°N is from the east or northeast, while over the western North Pacific from Okinawa to the Kamchatka Peninsula and along the California coast the prevailing winds are from the north and northwest. Winds average force 3 to 5 over these regions as well as over the Bering and Chukchi Seas, where the prevailing winds are easterly. From Japan to the Gulf of Alaska the prevailing winds are from the western quadrant and average force 4 to 6.

GALES. Gale frequencies of 5 percent or greater are encountered mainly between 30°N and 65°N across the open waters of the North Pacific. Frequencies of 10 percent or more are found over the western half of the

North Pacific between 142°E to 170°W and 32°N to 59°N and over most of the Gulf of Alaska with the exception of the coastal areas.

EXTRATROPICAL CYCLONES. The major region of cyclogenesis extends from eastern Japan to just east of the International Date Line and from 30°N to 45°N. A small secondary area of cyclogenesis is centered near 40°N, 140°W. The primary storm track runs from southern Japan to the Gulf of Alaska. One secondary track runs from northern Japan to the Bering Sea with a second track running south of the primary track from 160°W to western Canada.

TROPICAL CYCLONES. During February there is practically no chance of encountering a tropical storm in the eastern North Pacific. However, in the western North Pacific over an average 10-yr period, four tropical cyclones should reach force 8 ($\geq$ 34 kn) and of these half should reach typhoon strength ($\geq$ 64 kn).

WAVE HEIGHTS. Wave heights of 12 ft or higher are observed 10 percent or more of the time in most areas between Japan and Canada and between 20°N and the St. Lawrence Island. Ten-percent frequencies also occur southeast of Hawaii, in the northern portion of the Sea of Japan, and from the northern portion of the South China Sea to the southern portion of the East China Sea. Frequencies of 20 percent are observed in the Formosa Strait with frequencies as high as 30 percent being observed in the western Pacific between 30°N and the Bering Sea and in an area centered over the northeast Pacific between the Aleutians and the Queen Charlotte Islands.

VISIBILITIES. South of latitude 40°N visibilities less than 2 mi are generally found only along the Asian coast. Frequencies of 10 percent cover most areas north of 43°N, with frequencies of 20 percent or more covering most of the Sea of Okhotsk and the Bering Sea. In the center of the Sea of Okhotsk and from the eastern side of the Kamchatka Peninsula east through the center of the Bering Sea, frequencies of 30 percent are prevalent.

NORTH ATLANTIC, MARCH

WEATHER. The Icelandic Low has now filled to 1002 mb near 60°N, 35°W. The Low off the northwestern coast of Norway is 1007 mb. The Azores High is still 1020 mb near 30°N, 30°W. The pressure gradient continues to relax, but very severe storms still occur. The surface air temperature has changed very little. The mean 0°C isotherm extends from Nordkapp to the coast of eastern Greenland to Kap Farvel to 100 mi off Cape Race to Cape Sable. Ninety-eight percent of the temperatures range from -16°C to 28°C. Over the Mediterranean Sea the range is 12°C to 16°C. Along latitude 40°N the mean air temperature is 5°C off New Jersey to 14°C off Portugal. The mean 0°C sea-surface temperature parallels the eastern Greenland coast and western coast to 65°N, then to off Cape Race to northern Nova Scotia. The sea temperature along 40°N is 5°C at New Jersey to 14°C at Portugal, increasing to 16°C at 40°W.

WINDS. Average windspeeds are slightly less in March than in February. Prevailing winds are westerly over the northwest quadrant of the North Atlantic, except over the Labrador Sea where they are northwesterly. Over the northeast quadrant, prevailing winds are southwesterly, while south of 25°N they are predominantly easterly. From a point 300 mi east of Cape Hatteras northeastward to the Norwegian Sea and then west to the Labrador coast, winds average force 4 to 6. The trade winds, between 25°N and the Equator, average force 3 to 4, with the exception of an area in the Caribbean Sea just north of Colombia, where they average force 4 to 5. In the Mediterranean Sea the prevailing winds are northwesterly at force 3 to 4 with slightly stronger winds over the Gulf of Lions.

GALES. The frequency of gales (force 8 or higher) has decreased from February. The largest 10-percent area roughly lies between the bounds of the Labrador Sea to off Cape Hatteras to the northern regions of the Norwegian Sea. There are also 10-percent regions within the central North Sea and the Gulf of Lions. The maximum occurrence, 20 percent, is along the southeastern coast of Greenland and north of 68°N in the Greenland Sea.

EXTRATROPICAL CYCLONES. The main area for cyclogenesis extends along the Gulf Coast and east coast of the United States to as far north as Long Island, where it turns northeastward to approximately 55°N, 45°W. Other major areas of cyclonic development are along the eastern half of the Bay of Biscay, the northwestern Mediterranean, and the Denmark Strait-southern Iceland region. Primary tracks lead from either the Great Lakes toward the waters off Iceland and Greenland or from the Carolinas into the central North Atlantic. Secondary tracks cross Hudson Bay, southern Norway and Sweden, and the northern Mediterranean Sea.

TROPICAL CYCLONES. Only one tropical storm, a hurricane in the Lesser Antilles in 1908, has been reported in the past 104 yr.

WAVE HEIGHTS. Waves of 12 ft or higher occur 10 percent or more of the time north of 30°N except for most coastal and frozen northern waters. Frequencies of 10 percent also appear over the Mediterranean Sea from the Gulf of Lions south to 40°N and over the Caribbean Sea off Barranquilla, Colombia. A large area that extends south of Iceland to 50°N and between Greenland and Ireland sustains a 40-percent frequency of 12-ft waves or higher and a region in the northeast corner supports a frequency of 50 percent.

VISIBILITY. Ten percent of the observations report poor visibilities (less than 2 mi) in an area north of a line extending from Long Island to the Labrador Sea and south of Kap Farvel to northern Iceland and the Barents Sea. Coastal areas along the North Sea, Baltic Sea, and British Isles also report poor visibilities 10 percent or more of the time. The highest frequency of poor visibility, 20 percent or more, occurs in the vicinity of Belle Isle, the Greenland Sea, and the Gulf of Finland.

NORTH PACIFIC, MARCH

WEATHER. The Aleutian Low has filled to 1004 mb centered over the Near Islands. A second 1007-mb Low is over the Gulf of Alaska. The Pacific High at 1023 mb near 30°N, 138°W, had expanded northward and westward. The Siberian High now only affects the Yellow Sea. The 0°C mean air temperature isotherm extends from the Alaska Peninsula to northern

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Hokkaido. The mean temperature ranges from -16°C at the Bering Strait to 28°C at the Equator. Ninety-eight percent of the air temperatures range from -40°C to 32°C. Along latitude 40°N the range is 4°C over the Sea of Japan to 11°C off California. The 0°C mean sea-surface temperature extends from the Alaska Peninsula to Hokkaido with northward bulges over the Bering Sea and Sea of Okhotsk. Along latitude 40°N it ranges from 4°C over the Sea of Japan to 12°C off California.

WINDS. From Japan to northern California and southern Alaska, the prevailing winds are from the west to southwest averaging force 4 to 6. The remaining regions of the Pacific maintain average winds of force 3 to 5. Northeasterly winds prevail south of 25°N and north of 60°N with north-to-northwesterly winds occurring over the Sea of Okhotsk, the Sea of Japan, the Yellow Sea, and off the coast of California.

GALES. Most gale-force winds over the North Pacific Ocean occur 5 percent or more of the time from east-central Japan to as far north as the Bering Sea and the Gulf of Alaska and as far east as Canada and the northwestern United States. Frequencies of 10 percent or more are mainly confined to the western North Pacific from 32°N to 57°N and lie between the Commander and Fox Islands in the north and between Japan and the International Date Line in the south.

EXTRATROPICAL CYCLONES. During March the major area of cyclogenesis spans some 600 mi in width and extends in length from Japan to near 45°N, 170°E. The primary storm track crosses southern Japan, passing through the center of the major area of cyclogenesis. On the northeast edge of this area of cyclogenesis, the primary track branches with the LOWs, either heading north toward the Aleutians or east toward Canada. A second primary track branches from the northwestern edge of the area of cyclogenesis into the southern region of the Bering Sea. Secondary tracks move southeast out of Asia across northern Japan, north across the central region of the Gulf of Alaska, and southeast into the northwestern United States.

TROPICAL CYCLONES. For the period of record 1949 through 1980 only one tropical storm has been observed during March in the eastern North Pacific. However, on the averave in the western North Pacific, a tropical storm ($\geq$ 34 kn) will be observed once every 2 yr and a typhoon ($\geq$64 kn) once every 5 yr.

WAVE HEIGHTS. Wave heights of at least 12 ft are observed more than 10 percent of the time in most areas between Japan and North America and between the Bering Sea and Hawaii. Frequencies increase to 30 percent over the western Pacific between the Kuril Islands and the Pribilof Islands and between 155°E and 178°W near the 40th parallel. Wave heights of this magnitude are also observed 10 percent of the time between the Marshall and Hawaiian Islands and in the waters surrounding Taiwan.

VISIBILITIES. During March, increased frequencies of visibilities less than 2 mi occur over the East China Sea with frequencies reaching 20 percent off the China coast at Shanghai. Most regions north of 40°N show frequencies of at least 5 to 10 percent with frequencies exceeding 20 percent along most of the coastal areas of the Sea of Okhotsk and across most of the Bering Sea. The highest occurrences appear in the Bering Sea where frequencies of 30 percent are observed in several areas.